

Cisco MWR 2941 Router Command Reference, Release 15.1(3)MR

This document contains an alphabetical listing of new and revised commands specific to the Cisco MWR 2941 router.

Note For a general reference for Cisco IOS, see the documentation for Cisco IOS Software Releases 15.1S. The Cisco MWR 2941 does not necessarily support all of the commands listed in the 15.1S documentation.

Note For a list of supported IPv6 commands, see Chapter 1, "Supported IPv6 Commands."

The following commands are new or have been modified with Cisco MWR 2941 Release 3.5:

- errdisable recovery, page -98
- ip rtp header-compression, page -192
- platform header-compression match access-group, page -301
- show ip rtp header-compression, page -549
- show platform hardware, page -578
- show storm-control, page -617
- show storm-control history, page -619
- storm-control, page -666

ais

To enable the Alarm Indication Signal (AIS) function for a specific maintenance association, use the **ais** command in Ethernet CFM service configuration mode. To disable AIS configuration, use the **no** form of this command.

ais [**expiry-threshold** *threshold* | **level** *level-id* | **period** *seconds* | **suppress-alarms**]

no ais [**expiry-threshold** | **level** | **period** | **suppress-alarms**]

Syntax Description

expiry-threshold	(Optional) Configures the expiry threshold.
threshold	(Optional) Integer from 2 to 255 that is a count. If no MEPs are received within an interval of the threshold multiplied by the transmission period, the MEP clears the AIS defect condition. The default is 3.5.
level	(Optional) Indicates a maintenance level where AIS frames for maintenance endpoints (MEPs) belonging to the service will be sent.
level-id	(Optional) Integer from 0 to 7 that identifies the maintenance level.
period	(Optional) Configures the AIS transmission period for all MEPs in the maintenance association.
seconds	(Optional) Integer value 1 or 60 that indicates the AIS transmission period in seconds. The default is 60.
suppress-alarms	(Optional) Configures alarm suppression.

Command Default

The AIS function is enabled on specific maintenance associations.

Command Modes

Ethernet CFM service configuration (config-ecfm-srv)

Command History

Release	Modification
15.0(1)XA	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Alarms are suppressed when a MEP goes into an RX AIS (receipt of an AIS frame) defect condition.

When you specify the **level** keyword with the **ais** command, you can transmit AIS messages to a higher maintenance association without configuring a maintenance intermediate point (MIP) for that maintenance association.

Output of the **show running all** command shows “ais expiry-threshold 3.5” when the default expiry threshold is configured, “ais period 60” when the default transmission period is configured, and “no ais suppress-alarms” when the default value for the **suppress-alarms** option is configured.

Examples

The following example shows how to enable the AIS function at level 5 with a transmission period of one second:

```
Router(config)# ethernet cfm domain operatorA level 5
Router(config-ecfm)# service vlan-id 10 port
Router(config-ecfm-srv)# ais period 1
Router(config-ecfm-srv)# ais level 5
```

Related Commands

Command	Description
ethernet cfm global	Enables connectivity fault management (CFM) globally on a device.

alarm

To configure an alarm when fault alarms are enabled, use the **alarm** command in Ethernet connectivity fault management (CFM) interface configuration mode. To remove the configuration, use the **no** form of this command.

alarm {**delay** *mseconds* | **notification** {**all** | **error-xcon** | **mac-remote-error-xcon** | **none** | **remote-error-xcon** | **xcon**} | **reset** *mseconds*}

no alarm {**delay** | **notification** {**all** | **error-xcon** | **mac-remote-error-xcon** | **none** | **remote-error-xcon** | **xcon**} | **reset**}

Syntax Description

delay	Sets a delay time value during which one or more defects must be present before a fault alarm is issued.
mseconds	Integer from 2500 to 10000 that specifies the number of milliseconds for either a delay or a reset of an alarm. The default is 2500 for the **delay** option. The default is 10000 for the **reset** option.
notification	Sets the defects that are to be reported if fault alarms are enabled.
all	Reports all defects: DefRDI, DefMACStatus, DefRemote, DefError, and DefXcon.
error-xcon	Reports only DefError and DefXcon defects.
mac-remote-error-xcon	Reports only DefMACStatus, DefRemote, DefError, and DefXcon (default) defects. This option is the default.
none	No defects are reported.
remote-error-xcon	Reports only DefRemote, DefError, and DefXcon defects.
xcon	Reports only DefXcon defects.
reset	Sets a reset time value that, after a fault alarm, no defects must be present before another fault alarm is enabled.

Command Default

Alarms are disabled.

Command Modes

Ethernet CFM interface configuration (config-if-ecfm-mep)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command overrides the global **ethernet cfm alarm** command.

If a higher priority defect occurs after a lower priority defect has triggered an alarm but before the alarm has reset, immediately issue another fault alarm for the higher priority defect.

Output of the **show running all** command displays “alarm delay 2500” when the default value for the **delay** option is configured, “alarm mac-remote-error-xcon” when the default value for the **notification** option is configured, and “alarm reset 10000” when the default value for the **reset** option is configured.

Examples

The following example shows how to set up notifications for all defects:

```
Router(config)# ethernet cfm domain test level 5
Router(config-ecfm)# service vlan-id 17 vlan 17
Router(config-ecfm-srv)# exit
Router(config-ecfm)# exit
Router(config)# interface gigabitethernet 0/2
Router(config-if)# ethernet cfm interface
Router(config-if)# ethernet cfm mep domain test mpid 5 vlan 17
Router(config-if-ecfm-mep)# alarm notification all
Router(config-if-ecfm-mep)#
```

```
The following example shows how to set the time during which one or more defects must be
present before a fault alarm is issued to 7000 milliseconds:
```

```
Router(config)# ethernet cfm domain test level 5
Router(config-ecfm)# service vlan-id 17 vlan 17
Router(config-ecfm-srv)# exit
Router(config-ecfm)# exit
Router(config)# interface gigabitethernet 0/2
Router(config-if)# ethernet cfm interface
Router(config-if)# ethernet cfm mep domain test mpid 5 vlan 17
Router(config-if-ecfm-mep)# alarm delay 7000
```

Related Commands

Command	Description
ethernet cfm alarm	Configures an alarm for Ethernet CFM.
show running all	Shows the running configuration with default values.

atm ilmi-keepalive

To enable Interim Local Management Interface (ILMI) keepalives, use the **atm ilmi-keepalive** command in interface configuration mode. To disable ILMI keepalives, use the **no** form of this command.

atm ilmi-keepalive [*seconds*]

no atm ilmi-keepalive [*seconds*]

Syntax Description

seconds	(Optional) Number of seconds between keepalives. Values less than 3 seconds are rounded up to 3 seconds, and there is no upper limit.

Command Default

3 seconds

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Examples

The following example enables ILMI keepalives for the ATM interface 1/0:

```
interface atm 1/0
 atm address-registration
 atm ilmi-keepalive
```

Related Commands

Command	Description
atm address-registration	Enables the router to engage in address registration and callback functions with the ILMI.

atm vc-per-vp

To set the maximum number of virtual channel identifier (VCIs) to support per virtual path identifier (VPI), use the **atm vc-per-vp** interface configuration command. To restore the default value, use the **no** form of this command.

atm vc-per-vp *number*

no atm vc-per-vp

Syntax Description

number	Maximum number of VCIs to support per VPI. Valid values are: 16, 128, 256, 1024, 2048, 4096, 16384, and 65536.

Defaults

1024

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command controls the memory allocation in the ATM Interface Processor (AIP), ATM port adapter, ATM network module, or network processor module (NPM) to deal with the VCI table. It defines the maximum number of VCIs to support per VPI; it does not bound the VCI numbers.

An invalid VCI causes a warning message to be displayed.

Note Changing the value of the **atm vc-per-vp** command on one interface affects all of the interfaces on that network module.

Table 1-1 lists the possible VCI ranges and corresponding VPI ranges.

Table 1-1 VCI and VPI Ranges for Cisco 2600 and 3600 Series with IMA

VCI Range	VPI Range
0–255	0–15, 64–79, 128–143, and 192–207
0–511	0–15, 64–79
0–1023	0–15

Examples

The following example sets the maximum number of VCIs per VPI to 512:

```
Router(config)# interface atm1/0
Router(config-if)# atm vc-per-vp 512
```

Related Commands

Command	Description
pvc	Configures the PVC interface.

backup delay

To specify how long a backup pseudowire (PW) virtual circuit (VC) should wait before resuming operation after the primary PW VC goes down, use the **backup delay** command in interface configuration mode or xconnect configuration mode. To return to the default so that as soon as the primary fails, the secondary is immediately brought up without delay, use the **no** form of this command.

backup delay *enable-delay* {*disable-delay* | **never**}

no backup delay *enable-delay* {*disable-delay* | **never**}

Syntax Description

enable-delay	Number of seconds that elapse after the primary PW VC goes down before the Cisco IOS software activates the secondary PW VC. The range is 0 to 180. The default is 0.
disable-delay	Number of seconds that elapse after the primary PW VC comes up before the Cisco IOS software deactivates the secondary PW VC. The range is 0 to 180. The default is 0.
never	The secondary PW VC does not fall back to the primary PW VC if the primary PW VC becomes available again, unless the secondary PW VC fails.

Command Default

If a failover occurs, the xconnect redundancy algorithm immediately switches over or falls back to the backup or primary member in the redundancy group.

Command Modes

Interface configuration

Xconnect configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRB1	This command was integrated into Cisco IOS Release 12.2(33)SRB1.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Examples

The following example shows a Multiprotocol Label Switching (MPLS) xconnect with one redundant peer. After a switchover to the secondary VC occurs, there is no fallback to the primary VC unless the secondary VC fails.

```
Router# config t
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# exit
Router(config)# interface atm1/0
Router(config-if)# xconnect 10.0.0.1 50 pw-class mpls
```

```
Router(config-if-xconn)# backup peer 10.0.0.2 50
Router(config-if-xconn)# backup delay 0 never
Router(config-if-xconn)# exit
Router(config-if)# exit
Router(config)# exit
```

The following example shows an MPLS xconnect with one redundant peer. The switchover does not begin unless the PW has been down for 3 seconds. After a switchover to the secondary VC occurs, there is no fallback to the primary until the primary VC has been reestablished and is up for 10 seconds.

```
Router# config t
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# exit
Router(config)# interface atm1/0
Router(config-if)# xconnect 10.0.0.1 50 pw-class mpls
Router(config-if-xconn)# backup peer 10.0.0.2 50
Router(config-if-xconn)# backup delay 3 10
Router(config-if-xconn)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
backup peer	Configures a redundant peer for a PW VC.

backup peer

To specify a redundant peer for a pseudowire (PW) virtual circuit (VC), use the **backup peer** command in interface configuration mode or xconnect configuration mode. To remove the redundant peer, use the **no** form of this command.

backup peer *peer-router-ip-addr vcid* **[pw-class** *pw-class-name***]**

no backup peer *peer-router-ip-addr vcid*

Syntax Description

peer-router-ip-addr	IP address of the remote peer.
vcid	The 32-bit identifier of the VC between the routers at each end of the layer control channel.
pw-class	(Optional) PW type. If not specified, the PW type is inherited from the parent xconnect.
pw-class-name	(Optional) Name of the PW you created when you established the PW class.

Command Default

No redundant peer is established.

Command Modes

Interface configuration

Xconnect configuration

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

The combination of the *peer-router-ip-addr* and *vcid* arguments must be unique on the router.

Examples

The following example shows an MPLS xconnect with one redundant peer:

```
Router# config t
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls
```

```
Router(config-pw-class)# exit
Router(config)# interface atm1/0
Router(config-if)# xconnect 10.0.0.1 100 pw-class mpls
Router(config-if-xconn)# backup peer 10.0.0.2 200
Router(config-if-xconn)# exit
Router(config-if)# exit
Router(config)# exit
```

The following example shows a backup peer configuration for an ATM interface:

```
Router# config t
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# exit
Router(config)# interface atm0/1
Router(config-if)# xconnect 10.0.0.2 1 pw-class mpls
Router(config-if-xconn)# backup peer 10.0.0.2 100 pw-class mpls
Router(config-if-xconn)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
backup delay	Specifies how long the backup PW VC should wait before resuming operation after the primary PW VC goes down.

bandwidth (policy-map class)

To specify or modify the bandwidth allocated for a class belonging to a policy map, or to enable ATM overhead accounting, use the **bandwidth** command in policy-map class configuration mode. To remove the bandwidth specified for a class or disable ATM overhead accounting, use the **no** form of this command.

bandwidth {*bandwidth-kbps* | **remaining percent** *percentage* | **percent** *percentage*}

no bandwidth

Syntax Description

bandwidth-kbps	Amount of bandwidth, in kilobits per second (kbps), to be assigned to the class. The amount of bandwidth varies according to the interface and platform in use.
remaining percent *percentage*	Percentage of guaranteed bandwidth based on a relative percent of available bandwidth. The range is from 1 to 100.
percent *percentage*	Percentage of guaranteed bandwidth based on an absolute percent of available bandwidth that is set aside for the priority class. The range is from 1 to 100.

Command Default

No bandwidth is specified.

ATM overhead accounting is disabled.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE and was implemented on Versatile Interface Processor (VIP)-enabled Cisco 7500 series routers.
12.0(7)T	The **percent** keyword was added.
12.0(17)SL	This command was introduced on the Cisco 10000 series router.
12.0(22)S	Support for the **percent** keyword was added on the Cisco 10000 series router.
12.0(23)SX	Support for the **remaining percent** keyword was added on the Cisco 10000 series router.
12.1(5)T	This command was implemented on VIP-enabled Cisco 7500 series routers.
12.2(2)T	The **remaining percent** keyword was added.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(31)SB	This command was implemented on the Cisco 10000 series routers.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router, and was enhanced for ATM overhead accounting on the Cisco 10000 series router for the PRE3.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Release	Modification
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(31)SB6	This command was enhanced to specify an offset size when calculating ATM overhead and was implemented on the Cisco 10000 series router for the PRE3.
12.2(33)SRC	Support for the Cisco 7600 series router was added.
12.2(33)SB	Support for the Cisco 7300 series router was added.
12.4(20)T	Support was added for hierarchical queueing framework (HQF) using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Configuring a Policy Map

Use the **bandwidth** command when you configure a policy map for a class defined by the **class-map** command. The **bandwidth** command specifies the bandwidth for traffic in that class. Class-based weighted fair queueing (CBWFQ) derives the weight for packets belonging to the class from the bandwidth allocated to the class. CBWFQ then uses the weight to ensure that the queue for the class is serviced fairly.

Configuring Strict Priority with Bandwidth

You can configure only one class with strict priority. Other classes cannot have priority or bandwidth configuration. To configure minimum bandwidth for another class, use the **bandwidth remaining percent** command.

Specifying Bandwidth as a Percentage

Besides specifying the amount of bandwidth in kilobits per second (kbps), you can specify bandwidth as a percentage of either the available bandwidth or the total bandwidth. During periods of congestion, the classes are serviced in proportion to their configured bandwidth percentages. The bandwidth percentage is based on the interface bandwidth or when used in a hierarchical policy. Available bandwidth is equal to the interface bandwidth minus the sum of all bandwidths reserved by the Resource Reservation Protocol (RSVP) feature, the IP RTP Priority feature, and the low latency queueing (LLQ) feature.



Note It is important to remember that when the **bandwidth remaining percent** command is configured, hard bandwidth guarantees may not be provided and only relative bandwidths are assured. That is, class bandwidths are always proportional to the specified percentages of the interface bandwidth. When the link bandwidth is fixed, class bandwidth guarantees are in proportion to the configured percentages. If the link bandwidth is unknown or variable, the router cannot compute class bandwidth guarantees in kbps.

The router converts the specified bandwidth to the nearest multiple of 1/255 (ESR–PRE1) or 1/65,535 (ESR–PRE2) of the interface speed. Use the **show policy-map interface** command to display the actual bandwidth.

Restrictions

The following restrictions apply to the **bandwidth** command:

- The amount of bandwidth configured should be large enough to also accommodate Layer 2 overhead.
- A policy map can have all the class bandwidths specified in kbps or all the class bandwidths specified in percentages, but not a mix of both in the same class. However, the unit for the **priority** command in the priority class can be different from the bandwidth unit of the nonpriority class.
- When the **bandwidth percent** command is configured, and a policy map containing class policy configurations is attached to the interface to stipulate the service policy for that interface, available bandwidth is assessed. If a policy map cannot be attached to a particular interface because of insufficient interface bandwidth, the policy is removed from all interfaces to which it was successfully attached. This restriction does not apply to the **bandwidth remaining percent** command.

Related Commands

Command	Description
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
class-map	Creates a class map to be used for matching packets to a specified class.
max-reserved-bandwidth	Changes the percent of interface bandwidth allocated for CBWFQ, LLQ, and IP RTP Priority.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
priority	Specifies the priority of a class of traffic belonging to a policy map.
queue-limit	Specifies or modifies the maximum number of packets the queue can hold for a class policy configured in a policy map.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.

bfd all-interfaces

To enable Bidirectional Forwarding Detection (BFD) for all interfaces participating in the routing process, use the **bfd all-interfaces** command in router configuration mode. To disable BFD for all interfaces, use the **no** form of this command.

bfd all-interfaces

no bfd all-interfaces

Syntax Description

This command has no arguments or keywords.

Command Default

BFD is not enabled on the interfaces participating in the routing process.

Command Modes

Router configuration

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.4(4)T	This command was integrated into Cisco IOS Release 12.4(4)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

There are two methods to configure routing protocols to use BFD for failure detection. To enable BFD for all neighbors of a routing protocol, enter the **bfd all-interfaces** command in router configuration mode. If you do not want to enable BFD on all interfaces, enter the **bfd interface** command in router configuration mode.

Examples

The following example shows BFD enabled for all Intermediate System-to-Intermediate System (IS-IS) neighbors:

```
Router> enable
Router# configure terminal
Router(config)# router isis tag1
Router(config-router)# bfd all-interfaces
Router(config-router)# end
```

The following example shows BFD enabled for all Open Shortest Path First (OSPF) neighbors:

```
Router> enable
Router# configure terminal
```

```
Router(config)# router ospf 123
Router(config-router)# bfd all-interfaces
Router(config-router)# end
```

Related Commands

Command	Description
bfd	Sets the baseline BFD session parameters on an interface.
bfd interface	Enables BFD on a per-interface basis for a BFD peer.

bfd interval

To set the baseline Bidirectional Forwarding Detection (BFD) session parameters on an interface, use the **bfd** command in interface configuration mode. To remove the baseline BFD session parameters, use the **no** form of this command.

bfd interval *milliseconds* **min_rx** *milliseconds* **multiplier** *multiplier-value*

no bfd interval *milliseconds* **min_rx** *milliseconds* **multiplier** *multiplier-value*

Syntax Description

interval *milliseconds*	Specifies the rate at which BFD control packets will be sent to BFD peers. The configurable time period for the *milliseconds* argument is from 50 to 999 milliseconds (ms).
min_rx *milliseconds*	Specifies the rate at which BFD control packets will be expected to be received from BFD peers. The configurable time period for the *milliseconds* argument is from 1 to 999 milliseconds (ms).
multiplier *multiplier-value*	Specifies the number of consecutive BFD control packets that must be missed from a BFD peer before BFD declares that the peer is unavailable and the Layer 3 BFD peer is informed of the failure. The configurable value range for the *multiplier-value* argument is from 3 to 50.

Command Default

No baseline BFD session parameters are set.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.4(4)T	This command was integrated into Cisco IOS Release 12.4(4)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Examples

The following example shows the BFD session parameters set for Fast Ethernet interface 3/0:

```
Router> enable
Router# configure terminal
Router(config)# interface vlan1
Router(config-if)# bfd interval 50 min_rx 3 multiplier 3
Router(config-if)# end
```

Related Commands

Command	Description
bfd all-interfaces	Enables BFD for all interfaces for a BFD peer.
bfd interface	Enables BFD on a per-interface basis for a BFD peer.
ip ospf bfd	Enables BFD on a specific interface configured for OSPF.

cbr

To configure the constant bit rate (CBR) for the ATM circuit emulation service (CES) for an ATM permanent virtual circuit (PVC), use the **cbr** command in the appropriate configuration mode. To restore the default, use the **no** form of this command.

cbr *rate*

no cbr *rate*

Syntax Description

rate	Constant bit rate (also known as the average cell rate) for ATM CES. Valid values are 32–1920 kbps.

Command Default

The CBR is not configured.

Command Modes

Interface-ATM-VC configuration (for ATM PVCs and SVCs)
PVC range configuration (for an ATM PVC range)
PVC-in-range configuration (for an individual PVC within a PVC range)
ATM PVP configuration

Command History

Release	Modification
12.0	This command was introduced for the ATM CES on the Cisco MC3810.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.
12.2(5)	Support was added for the PA-A3 port adapter on the Cisco 7200 series routers.
12.2(7)	Support was added for the PA-A3 port adapter on the Cisco 7500 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
Cisco IOS XE Release 2.3	This command was made available in ATM PVP configuration mode.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Examples

The following example configures the constant bit rate on ATM PVC 20:

```
pvc 20
 cbr 56
```

Related Commands

Command	Description
pvc	Creates or assigns a name to an ATM PVC, specifies the encapsulation type on an ATM PVC, and enters interface-ATM-VC configuration mode.

cdp enable

To enable Cisco Discovery Protocol (CDP) on an interface, use the **cdp enable** command in interface configuration mode. To disable CDP on an interface, use the **no** form of this command.

cdp enable

no cdp enable

Syntax Description

This command has no arguments or keywords.

Defaults

Enabled at the global level and on all supported interfaces.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

CDP is enabled by default at the global level and on each supported interface in order to send or receive CDP information. However, some interfaces, such as ATM interfaces, do not support CDP.



Note The **cdp enable**, **cdp timer**, and **cdp run** commands affect the operation of the IP on demand routing feature (that is, the **router odr** global configuration command). For more information on the **router odr** command, see the "On-Demand Routing Commands" chapter in the *Cisco IOS Command Reference, Volume 2 of 3: Routing Protocols* document.

Examples

In the following example, CDP is disabled on the Ethernet 0 interface only:

```
Router# show cdp
Global CDP information
    Sending CDP packets every 60 seconds
    Sending a holdtime value of 180 seconds
    Sending CDPv2 advertisements is enabled
Router# config terminal
```

```
Router(config)# interface ethernet 0
Router(config-if)# no cdp enable
```

Related Commands

Command	Description
cdp run	Reenables CDP on a Cisco device.
cdp timer	Specifies how often the Cisco IOS software sends CDP updates.
router odr	Enables on-demand routing on a hub router.

cem-group

To create a circuit emulation (CEM) channel from one or more time slots of a T1 or E1 line, use the **cem-group** command in controller configuration mode. To remove a CEM group and release the associated time slots, use the **no** form of this command.

cem-group *group-number* {**unframed** | **timeslots** *time-slot-range*}

no cem-group *group-number*

Syntax Description

group-number	CEM identifier to be used for this group of time slots: • For T1 ports, the range is from 0 to 23. • For E1 ports, the range is from 0 to 30.
unframed	Specifies that a single CEM channel is being created, including all time slots, without specifying the framing structure of the line.
timeslots	Specifies that a list of time slots is to be used as specified by the *time-slot-range* argument. *time-slot-range*—Specifies the time slots to be included in the CEM channel. The list of time slots may include commas and hyphens with no spaces between the numbers.

Defaults

No CEM groups are defined.

Command Modes

Controller configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.4(12)MR2	This command was integrated into Cisco IOS Release 12.4(12)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command to create CEM channels on the T1 or E1 port.

Examples

The following example shows how to create a CEM channel:

SATOP

```
Router# config t
Router(config)# controller e1 0/0
Router(config-controller)# cem-group 0 unframed
Router(config-controller)# exit
```

```
Router(config)# interface cem 0/0
Router(config-if)# cem 0
Router(config-if-cem)# xconnect 10.10.10.10 200 encapsulation mpls
Router(config-if-cem-xconn)# exit
Router(config-if-cem)# exit
Router(config-if)# exit
Router(config)# exit
```

CESoPSN

```
Router# config t
Router(config)# controller e1 0/1
Router(config-controller)# cem-group 0 timeslots 1-31
Router(config-controller)# exit
Router(config)# interface cem 0/1
Router(config-if)# cem 0
Router(config-if-cem)# xconnect 10.10.10.10 200 encapsulation mpls
Router(config-if-cem-xconn)# exit
Router(config-if-cem)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
cem	Enters circuit emulation configuration mode.

class (policy-map)

To specify the name of the class whose policy you want to create or change or to specify the default class (commonly known as the class-default class) before you configure its policy, use the **class** command in policy-map configuration mode. To remove a class from the policy map, use the **no** form of this command.

class {*class-name* | **class-default**}

no class {*class-name* | **class-default**}

Syntax Description

class-name	Name of the class to be configured or whose policy is to be modified. The class name is used for both the class map and to configure a policy for the class in the policy map.
class-default	Specifies the default class so that you can configure or modify its policy.

Command Default

No class is specified.

Command Modes

Policy-map configuration (config-pmap)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.0(7)S	This command was integrated into Cisco IOS Release 12.0(7)S.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.2(14)SX	Support for this command was introduced on Cisco 7600 routers.
12.2(17d)SXB	This command was implemented on the Cisco 7600 router and integrated into Cisco IOS Release 12.2(17d)SXB.
12.2(18)SXE	The **class-default** keyword was added to the Cisco 7600 router.
12.4(4)T	The **insert-before** *class-name* option was added.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router.
12.2(18)ZY	The **insert-before** *class-name* option was integrated into Cisco IOS Release 12.2(18)ZY on the Catalyst 6500 series of switches equipped with the Programmable Intelligent Services Accelerator (PISA).
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers. The **fragment** *fragment-class-name* and **service-fragment** *fragment-class-name* options were introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release does not support the **fragment**, **insert-before**, or **service-fragment** parameters.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the **fragment**, **insert-before**, or **service-fragment** parameters.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **fragment**, **insert-before**, or **service-fragment** parameters. The release also does not support Weighted Random Early Detection (WRED).
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Policy Map Configuration Mode

Within a policy map, the **class** (policy-map) command can be used to specify the name of the class whose policy you want to create or change. First, the policy map must be identified.

To identify the policy map (and enter the required policy-map configuration mode), use the **policy-map** command before you use the **class** (policy-map) command. After you specify a policy map, you can configure policy for new classes or modify the policy for any existing classes in that policy map.

Class Characteristics

The class name that you specify in the policy map ties the characteristics for that class—that is, its policy—to the class map and its match criteria, as configured using the **class-map** command.

When you configure policy for a class and specify its bandwidth and attach the policy map to an interface, class-based weighted fair queueing (CBWFQ) determines if the bandwidth requirement of the class can be satisfied. If so, CBWFQ allocates a queue for the bandwidth requirement.

When a class is removed, available bandwidth for the interface is incremented by the amount previously allocated to the class.

The maximum number of classes that you can configure for a router—and, therefore, within a policy map—is 64.

Predefined Default Class

The **class-default** keyword is used to specify the predefined default class called class-default. The class-default class is the class to which traffic is directed if that traffic does not match any of the match criteria in the configured class maps.

Tail Drop or WRED

You can define a class policy to use either tail drop by using the **queue-limit** command. When using tail drop, note the following points:

- The **queue-limit** command cannot be used in the same class policy, but can be used in two class policies in the same policy map.
- You can configure the **bandwidth** command when the **queue-limit** command is configured in a class policy. The **bandwidth** command specifies the amount of bandwidth allocated for the class.
- For the predefined default class, you can configure the **fair-queue** (class-default) command. The **fair-queue** command specifies the number of dynamic queues for the default class. The **fair-queue** command can be used in the same class policy as the **queue-limit** command. It cannot be used with the **bandwidth** command.

Fragments

A default traffic class is marked as a fragment within a policy map class statement using the **fragment** keyword. Multiple fragments can then be classified collectively in a separate policy map that is created using the **service-fragment** keyword. When fragments are used, default traffic classes marked as fragments have QoS applied separately from the non-default traffic classes.

When using fragments, note the following guidelines:

- Only default traffic classes can be marked as fragments.
- The **fragment** *fragment-class-name* option within a default class statement marks that default class as a fragment.
- The **service-fragment** *fragment-class-name* option when defining a class in a policy map is used to specify a class of traffic within the Modular QoS CLI that contains all fragments sharing the same *fragment-class-name*.
- Fragments can only be used within the same physical interface. Policy maps with fragments sharing the same *fragment-class-name* on different interfaces cannot be classified collectively using a class with the **service-fragment** *fragment-class-name* option.

Examples

The following example configures three class policies included in the policy map called policy1. Class1 specifies policy for traffic that matches access control list 136. Class2 specifies policy for traffic with a CoS value of 2. The third class is the default class to which packets that do not satisfy configured match criteria are directed.

```
! The following commands create class-maps class1 and class2
! and define their match criteria:
class-map class1
 match access-group 136
class-map class2
 match cos 2


! The following commands create the policy map, which is defined to contain policy
! specification for class1 and the default class:
policy-map policy1

Router(config)# policy-map policy1
Router(config-pmap)# class class1
Router(config-pmap-c)# bandwidth 2000
Router(config-pmap-c)# queue-limit 40

Router(config-pmap)# class class-default
Router(config-pmap-c)# fair-queue 16
Router(config-pmap-c)# queue-limit 20
```

Related Commands

Command	Description
bandwidth (policy-map class)	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
class-map	Creates a class map to be used for matching packets to a specified class.
fair-queue (class-default)	Specifies the number of dynamic queues to be reserved for use by the class-default class as part of the default class policy.

Command	Description
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
queue-limit	Specifies or modifies the maximum number of packets the queue can hold for a class policy configured in a policy map.

class cem

To configure CEM interface parameters in a class that is applied to CEM interfaces together, use the **class cem** command in global configuration mode. This command works in the same manner for CEM interfaces as the **pseudowire-class** command does for xconnect.

class cem *class-name*

Syntax Description

class-name	The name of a CEM interface parameters class.

Command Modes

Global configuration

Command History

Release	Modification
12.4(12)MR2	This command was incorporated.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

The **class cem** command allows you to configure CEM interface parameters in a class that is applied to CEM interfaces together. A **class cem** command includes the following configuration settings:

- **dejitter-buffer** *dejitter-in-ms*
- **idle-pattern** *8-bit-idle-pattern*
- **payload-size** *payload-size-in-byte*

Note You can improve the performance of packet reordering on TDM/PWE connections by using the increasing the size of the dejitter buffer using the **dejitter-buffer** parameter.

Examples

The following example shows how to configure CEM interface parameters:

```
Router# config t
Router(config)# class cem mycemclass
Router(config-cem-class)# dejitter-buffer 10
Router(config-cem-class)# exit
Router(config)# interface cem 0/0
Router(config-if)# no ip address
Router(config-if)# cem 0
Router(config-if-cem)# xconnect 10.10.10.10 200 encapsulation mpls
Router(config-if-cem-xconn)# cem class mycemclass
Router(config-if-cem)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
dejitter-buffer	Specifies the size of the dejitter buffer used for network jitter in CEM configuration mode.
idle-pattern	Specifies the data pattern to transmit on the T1/E1 line when missing packets are detected on the PWE3 circuit in CEM configuration mode.
cem	Enters circuit emulation configuration mode.

class-map

To create a class map to be used for matching packets to a specified class, use the **class-map** command in global configuration mode. To remove an existing class map from the router, use the **no** form of this command. The **class-map** command enters class-map configuration mode in which you can enter one of the **match** commands to configure the match criteria for this class.

class map [match-all | match-any] *class-map-name*

no class map [match-all | match-any] *class-map-name*

Syntax Description

match-all	(Optional) Determines how packets are evaluated when multiple match criteria exist. Matches statements under this class map based on the logical AND function. One statement and another are accepted. If you do not specify the **match-all** or **match-any** keyword, the default keyword is **match-all**.
match-any	(Optional) Determines how packets are evaluated when multiple match criteria exist. Matches statements under this class map based on the logical OR function. One statement or another is accepted. If you do not specify the **match-any** or **match-all** keyword, the default keyword is **match-all**.
class-map-name	Name of the class for the class map. The name can be a maximum of 40 alphanumeric characters. The class name is used for both the class map and to configure a policy for the class in the policy map.

Command Default

No class map is configured by default.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.0(7)S	This command was integrated into Cisco IOS Release 12.0(7)S.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.2(14)SX	Support for this command was introduced on Cisco 7600 series routers.
12.2(17d)SXB	This command was implemented on the Cisco 7600 series routers and integrated into Cisco IOS Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(4)T	The **type stack** and **type access-control** keywords were added to support FPM. The **type port-filter** and **type queue-threshold** keywords were added to support Control Plane Protection.
12.4(6)T	The **type logging** keyword was added to support control plane packet logging.

Release	Modification
12.2(18)ZY	The **type stack** and **type access-control** keywords were integrated into Cisco IOS Release 12.2(18)ZY on the Catalyst 6500 series of switches equipped with the Programmable Intelligent Services Accelerator (PISA)
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release does not support the **stack, access-control, logging, port-filter, and queue-threshold parameters.**
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the **stack, access-control, logging, port-filter, and queue-threshold parameters.**
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use the **class-map** command to specify the class that you will create or modify to meet the class-map match criteria. This command enters class-map configuration mode in which you can enter one of the **match** commands to configure the match criteria for this class. Packets that arrive at either the input interface or the output interface (determined by how the **service-policy** command is configured) are checked against the match criteria configured for a class map to determine if the packets belong to that class.

When configuring a class map, you can use one or more **match** commands to specify match criteria. For example, you can use the **match access-group** command, the **match protocol** command, or the **match input-interface** command. The **match** commands vary according to the Cisco IOS release. For more information about match criteria and **match** commands, see the "Modular Quality of Service Command-Line Interface (CLI) (MQC)" chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Examples

The following example specifies class101 as the name of a class, and it defines a class map for this class. The class called class101 specifies policy for traffic that matches access control list 101.

```
Router(config)# class-map class101
Router(config-cmap)# match access-group 101
```

The following example shows how to access the **class-map** commands and subcommands, configure a class map named ipp5, and enter a match statement for **IP precedence 5**:

```
Router(config)# class-map ipp5
Router(config-cmap)# match ip precedence 5
```

Related Commands

Command	Description
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
class class-default	Specifies the default class for a service policy map.

Command	Description
match (**class-map**)	Configures the match criteria for a class map on the basis of port filter and/or protocol queue policies.
match access-group	Configures the match criteria for a class map on the basis of the specified ACL.
match input-interface	Configures a class map to use the specified input interface as a match criterion.
match ip dscp	Identifies one or more DSCP, AF, and CS values as a match criterion
match mpls experimental	Configures a class map to use the specified EXP field value as a match criterion.
match protocol	Configures the match criteria for a class map on the basis of the specified protocol.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or virtual circuit (VC) or to an output interface or VC to be used as the service policy for that interface or VC.
show class-map	Displays class-map information.
show policy-map interface	Displays the statistics and the configurations of the input and output policies that are attached to an interface.

class-map type control

To create an Intelligent Services Gateway (ISG) control class map, which defines the conditions under which the actions of a control policy map will be executed, use the **class-map type control** command in global configuration mode. To remove a control class map, use the **no** form of this command.

class-map type control [**match-all** | **match-any** | **match-none**] *class-map-name*

no class-map type control [**match-all** | **match-any** | **match-none**] *class-map-name*

Syntax Description

match-all	(Optional) The class map evaluates true if all of the conditions in the class map evaluates true.
match-any	(Optional) The class map evaluates true if any of the conditions in the class map evaluates true.
match-none	(Optional) The class map evaluates true if none of the conditions in the class map evaluates true.
class-map-name	Name of the class map.

Command Default

A control class map is not created.

Command Modes

Global configuration

Command History

Release	Modification
12.2(28)SB	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

A control class map specifies conditions that must be met for a control policy to be activated, and, optionally, the event that causes the class to be evaluated. A control class map can contain multiple conditions, each of which will evaluate to either true or false. Use the **match-any**, **match-all**, and **match-none** keywords to specify which, if any, conditions must evaluate true before the control policy will be executed.

A control policy map, which is configured with the **policy-map type control** command, contains one or more control policy rules. A control policy rule associates a control class map with one or more actions. Use the **class type control** command to associate a control class map with a control policy map.

Examples

The following example shows how to configure a control policy in which virtual private dial-up network (VPDN) forwarding is applied to anyone dialing in from “xyz.com”:

```
class-map type control match-all MY-FORWARDED-USERS
 match unauthenticated-domain "xyz.com"
!
policy-map type control MY-POLICY
 class type control MY-FORWARDED-USERS event session-start
  1 apply identifier nas-port
  2 service local
!
interface Dialer1
 service-policy type control MY-POLICY
```

Related Commands

Command	Description
class type control	Specifies a control class for which actions may be configured in an ISG control policy map.
policy-map type control	Creates or modifies a control policy map, which defines an ISG control policy.

class-map type traffic

To create or modify a traffic class map, which is used for matching packets to a specified Intelligent Services Gateway (ISG) traffic class, use the **class-map type traffic** command in global configuration mode. To remove a traffic class map, use the **no** form of this command.

class-map type traffic match-any *class-map-name*

no class-map type traffic match-any *class-map-name*

Syntax Description

match-any	Indicates that packets must meet one of the match criteria in order to be considered a member of the class.
class-map-name	Name of the class map.

Command Default

A traffic class map is not created.

Command Modes

Global configuration

Command History

Release	Modification
12.2(28)SB	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use the **class-map type traffic** command to specify the name of the ISG traffic class for which you want to create or modify traffic class map match criteria. Use of the **class-map type traffic** command enables traffic class-map configuration mode, in which you can enter match commands to configure the match criteria for this class. Packets are checked against the match criteria configured for a class map to determine if the packet belongs to that traffic class.

ISG traffic classes allow subscriber session traffic to be subclassified so that ISG features can be applied to constituent flows. Traffic policies, which define the handling of data packets, contain a traffic class and one or more features.

Once a traffic class map has been defined, use the **class type traffic** command to associate the traffic class map with a service policy map. A service can contain one traffic class, and the default class.

Examples

The following example shows the configuration of a traffic class map called “CLASS-ACL-101”. The class map is defined so that input traffic matching access list 101 will match the class. The traffic class map is then referenced in service policy map “mp3”.

```
class-map type traffic CLASS-ACL-101
 match access-group input 101
```

```
!
policy-map type service mp3
 class type traffic CLASS-ACL-101
  authentication method-list cp-mlist
  accounting method-list cp-mlist
  prepaid conf-prepaid
```

Related Commands

Command	Description
class type traffic	Specifies a named traffic class whose policy you want to create or change or specifies the default traffic class in order to configure its policy.
match access-group (ISG)	Configures the match criteria for a class map on the basis of the specified access control list (ACL).

clear ethernet cfm ais

To clear a maintenance endpoint (MEP) or server maintenance endpoint (SMEP) out of the Alarm Indication Signal (AIS) defect condition, use the **clear ethernet cfm ais** command in privileged EXEC mode.

Ethernet CFM IEEE 802.1ag Standard (CFM IEEE)

clear ethernet cfm ais {**domain** *domain-name* **mpid** *mpid-id* **vlan** *vlan-id* |
link-status interface Ethernet *number*}

Syntax Description

domain	Indicates that a maintenance domain is specified.
domain-name	String of a maximum of 154 characters that identifies the domain.
mpid	Indicates that a maintenance point ID (MPID) is specified.
mpid-id	An integer in the range of 1 to 8191 that identifies the MPID.
evc	Indicates that an Ethernet virtual circuit (EVC) is specified.
name	String identifying the EVC name.
vlan	Indicates that a VLAN is specified.
vlan-id	An integer in the range 1 to 4094 that identifies the VLAN.
link-status	Indicates either a SMEP or a link up/link down condition.
interface	Indicates that an interface is specified.
Ethernet	Specifies an Ethernet interface.
number	Integer from 0 to 15 that identifies the Ethernet interface.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
15.0(1)XA	This command was modified. The **evc** keyword and *name* argument are not supported in Cisco IOS Release 15.0(1)XA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support Ethernet Connectivity Fault Management (CFM) Cisco Proprietary Draft 1 (CFM D1).
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

If a MEP does not exit the AIS state when all errors are resolved, use the **clear ethernet cfm ais** command with the **domain** and **mpid** keywords to clear the AIS defect condition. If a SMEP does not exit the AIS state when all errors are resolved, use the **clear ethernet cfm ais** command with the **link-status interface** keywords to clear the AIS defect condition.

Examples

The following example shows how to clear a SMEP of an AIS defect condition:

```
Router# clear ethernet cfm ais link-status interface ethernet 0/0
```

The following examples show how to clear a MEP of an AIS defect condition:

```
Router# clear ethernet cfm ais domain xxx mpid 100 vlan 11
Router# clear ethernet cfm ais domain xxx mpid 100 evc test
```

Related Commands

Command	Description
ethernet cfm ais	Enables AIS generation from a SMEP.

clear ethernet cfm errors

To clear continuity check error conditions logged on a device, use the **clear ethernet cfm errors** command in privileged EXEC mode.

CFM IEEE 802.1ag Standard (CFM IEEE)

clear ethernet cfm errors [**domain-id** {*mac-address domain-number* | *domain-name* | **dns** *dns-name* | **null**}] [**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*}]

Syntax Description

domain	(Optional) Clears errors for a maintenance domain.
domain-name	(Optional) String of a maximum of 154 characters.
level	(Optional) Clears errors for a maintenance level.
level-id	(Optional) Integer in the range of 0 to 7 that identifies the maintenance level.
domain-id	(Optional) Clears errors by domain ID.
mac-address	(Optional) MAC address of the maintenance domain.
domain-number	(Optional) Integer in the range of 0 to 65535.
dns	(Optional) Specifies a domain name service (DNS).
dns-name	(Optional) String of a maximum of 43 characters.
null	(Optional) Indicates there is not a domain name.
service	(Optional) Specifies a maintenance association within the domain.
ma-name	(Optional) String that identifies the maintenance association.
ma-num	(Optional) Integer that identifies the maintenance association.
vlan-id	(Optional) Specifies a VLAN.
vlan-id	(Optional) Integer from 1 to 4094 that identifies the VLAN.
vpn-id	(Optional) Specifies a virtual private network (VPN).
vpn-id	(Optional) Integer from 1 to 32767 that identifies the VPN.

Command Default

The error database is unchanged; existing entries remain in the database.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.

Release	Modification
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support Ethernet Connectivity Fault Management (CFM) Cisco Proprietary Draft 1 (CFM D1).
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use the **clear ethernet cfm errors** command to purge error database entries that are not needed and when you want to work with a cleared database. Also, use this command with a specified domain if you want to clear errors for that domain.

In CFM IEEE, if a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

Examples

The following example shows a **clear ethernet cfm errors** command for errors at maintenance level 3. No output is generated when this command is issued.

```
Router# clear ethernet cfm errors level 3
```

The following example shows how to clear errors for a DNS on VLAN 17. No output is generated when this command is issued.

```
Router# clear ethernet cfm errors domain-id dns Service10 service vlan-id 17
```

Related Commands

Command	Description
show ethernet cfm errors	Displays CFM continuity check error conditions logged on a device since it was last reset or since the log was last cleared.

clear ethernet cfm maintenance-points remote

To purge the contents of the continuity check database, use the **clear ethernet cfm maintenance-points remote** command in privileged EXEC mode.

CFM IEEE 802.1ag Standard (CFM IEEE)

clear ethernet cfm maintenance-points remote [**domain** *domain-name*]

Syntax Description

domain	(Optional) Indicates that a maintenance domain is specified.
domain-name	(Optional) String of a maximum of 154 characters that identifies the domain.

Command Default

The continuity check database is unchanged; existing entries remain in the database.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **level** keyword used to configure CFM Draft 1.0.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command to clear the entire continuity check database or clear the database for a specific domain or level. When a domain is specified, only entries for that domain are purged. When a level is specified, entries for all domains at that level are purged.

If a maintenance domain is not specified, the entire continuity check database is cleared.

In CFM IEEE, the **level** keyword and *level-id* argument are not supported. Also, if a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

Examples

The following example shows a **clear ethernet cfm maintenance-points remote** command. No output is generated when this command is issued.

```
Router# clear ethernet cfm maintenance-points remote
```

Related Commands

Command	Description
show ethernet cfm maintenance-points remote	Displays information about remote maintenance points in the continuity check database.

clear ethernet cfm statistics

To clear a maintenance endpoint (MEP) or server maintenance endpoint (SMEP) out of the Alarm Indication Signal (AIS) defect condition, use the **clear ethernet cfm ais** command in privileged EXEC mode.

clear ethernet cfm statistics [**mpid** *mpid-id*]

Syntax Description

mpid	Indicates that a maintenance point ID (MPID) is specified.
mpid-id	An integer in the range of 1 to 8191 that identifies the MPID.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

If a MEP does not exit the AIS state when all errors are resolved, use the **clear ethernet cfm ais** command with the **domain** and **mpid** keywords to clear the AIS defect condition. If a SMEP does not exit the AIS state when all errors are resolved, use the **clear ethernet cfm ais** command with the **link-status interface** keywords to clear the AIS defect condition.

Examples

The following example shows how to clear connectivity fault management (CFM) statistics from a SMEP of an AIS defect condition:

```
Router# clear ethernet cfm statistics mpid 800
```

Related Commandss

Command	Description
clear ethernet cfm ais	Clears a MEP or SMEP out of the AIS defect condition.

clear ethernet cfm traceroute-cache

To remove the contents of the Ethernet CFM traceroute cache, use the **clear ethernet cfm traceroute-cache** command in privileged EXEC mode.

clear ethernet cfm traceroute-cache

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use the **clear ethernet cfm traceroute-cache** command to remove traceroute cache entries from previous traceroute operations issued on the device. This command also provides visibility into maintenance intermediate points and maintenance end points of a domain as they were recorded when the operation was performed.

Examples

The following example shows the **clear ethernet cfm traceroute-cache** command:

```
Router# clear ethernet cfm traceroute-cache
```

Related Commands

Command	Description
ethernet cfm traceroute cache	Enables caching of Ethernet CFM data learned through traceroute messages.
show ethernet cfm traceroute-cache	Displays the contents of the traceroute cache.

clear ip rtp header-compression

To clear Real-Time Transport Protocol (RTP) header compression structures and statistics, use the **clear ip rtp header-compression** privileged EXEC command.

clear ip rtp header-compression [*type number*]

Syntax Description

type number	(Optional) Interface type and number.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

If this command is used without an interface type and number, the command clears all RTP header compression structures and statistics.

Note IP Header compression will only work on host-generated traffic.

Examples

The following example clears the RTP header compression structures and statistics for multilink interface 1:

```
Router# clear ip rtp header-compression multilink1
```

Related Commands

Command	Description
ip rtp header-compression	Enables RTP header compression.

clear l2protocol-tunnel counters

To clear the layer 2 tunnel protocol counters on the router, use the **clear l2protocol-tunnel counters** command in Exec mode.

clear l2protocol-tunnel counters [**GigabitEthernet** *slot*/*port*]

Syntax Description

GigabitEthernet	(Optional) Specifies the a Gigabit Ethernet interface.
slot/*port*	Slot and port number.

Command Default

No default settings or behaviors.

Command Modes

EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command only applies to Gigabit Ethernet interfaces.

Examples

This example shows how to clear the layer 2 protocol counters for all interfaces:

```
Router# clear l2protocol-tunnel counters
Router#
```

Related Commands

Command	Description
l2protocol-tunnel	Enables the protocol tunneling on an interface and specifies the type of protocol to be tunneled.

clear link-protection statistics

To clear the counters for a link protection port, use the **show link-protection statistics** command in user EXEC or privileged EXEC mode.

clear link-protection statistics [interface *interface-name slot/port***]**

Syntax Description

interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot in which card is inserted.
port	The port of the card.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command only applies to Gigabit Ethernet interfaces.

Examples

The following examples provide sample output from the **show link-protection statistics** command:

```
Router# clear link-protection statistics
Router#
```

Related Commands

Command	Description
show link protection-group statistics	Displays the counters for a link protection port.

clear pw-udp vc counters

To clear counters for virtual circuits on a pseudowire connection using UDP encapsulation, use the **clear pw-udp vc counters** command in user EXEC or privileged EXEC mode.

clear pw-udp vc [vcid *vc-id*] **| [vcid** *vc-id-min vc-id-max*] **[destination** *ip-address* **|** *name*] **counters**

Syntax Description

vcid	(Optional) Allows you to enter a specific VC ID for which counters are to be cleared.
vc-id	(Optional) The VC ID number.
vc-id-min vc-id-max	(Optional) Range of VCs for which counters are to be cleared. The range is from 1 to 4294967295. (This argument is primarily used for legacy implementations.)
destination	(Optional) Information about the VCs that have been assigned VC IDs for the remote router you specify.
ip-address	(Optional) The IP address of the remote router.
name	(Optional) The name assigned to the remote router.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command only applies to pseudowire connections using UDP encapsulation.

Examples

The following example shows output from the **clear pw_udp vc counters** command:

```
Router# clear pw-udp vc destination 1.2.3.4 counters
Router#
```

Related Commands

Command	Description
show pw_udp vc	Displays counters for virtual circuits on pseudowire connections using UDP encapsulation.

clear spanning-tree counters

Use the **clear spanning-tree counters** privileged EXEC command to clear the spanning-tree counters.

clear spanning-tree counters [**interface** *interface-id*]

Syntax Description

interface *interface-id*	(Optional) Clear all spanning-tree counters on the specified interface. Valid interfaces include physical network node interfaces (NNIs), enhanced network interfaces (ENIs) on which spanning tree has been enabled, VLANs, and spanning-tree port channels. The VLAN range is 1 to 4094. The port-channel range is 1 to 48. **Note** Spanning Tree Protocol (STP) is not supported on user network interfaces (UNIs). Though visible in the command-line help, the command has no effect on UNIs or on ENIs on which STP is not enabled.

Command Default

None

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(25)EX	This command was introduced.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

If the *interface-id* is not specified, spanning-tree counters are cleared for all STP ports.

Examples

This example shows how to clear spanning-tree counters for all STP ports:

```
Router# clear spanning-tree counters
```

Related Commands

Command	Description
clear spanning-tree detected-protocols	Restarts the protocol migration process.

clear spanning-tree detected-protocols

To restart the protocol migration process, use the **clear spanning-tree detected-protocols** command in privileged EXEC mode.

clear spanning-tree detected-protocol [**interface** [*interface-type interface-number* | **port-channel** *pc-number* | **vlan** *vlan-interface*]

Syntax Description

interface	(Optional) Specifies the interface
interface-type	The type of interface for which you want to clear the detected spanning tree protocol.
interface-number	The number of the interface for which you want to clear the detected spanning tree protocol.
port-channel	Clears the detected spanning tree protocol for a port-channel.
pc-number	The port channel interface. Range: 1 to 282.
vlan	Clears the detected spanning tree protocol for a VLAN.
vlan-interface	The VLAN interface. Range: 1 to 4094.

Command Default

None

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

RSTP and MST have built-in compatibility mechanisms that allow them to interact properly with other versions of IEEE spanning tree or other regions. For example, a bridge running RSTP can send 802.1D BPDUs on one of its ports when it is connected to a legacy bridge. An MST bridge can detect that a port is at the boundary of a region when it receives a legacy BPDU or an MST BPDU that is associated with a different region. These mechanisms are not always able to revert to the most efficient mode. For example, an RSTP bridge that is designated for a legacy 802.1D stays in 802.1D mode even after the legacy bridge has been removed from the link. Similarly, an MST port assumes that it is a boundary port when the bridges, to which it is connected, have joined the same region. To force the MST port to renegotiate with the neighbors, enter the **clear spanning-tree detected-protocol** command.

If you enter the **clear spanning-tree detected-protocols** command with no arguments, the command is applied to every port of the Catalyst 6500 series switch.

Examples

This example shows how to restart the protocol migration on a specific interface:

```
Router# clear spanning-tree detected-protocol fa1/1
Router#
```

Related Commands

Command	Description
show spanning-tree mst	Displays information about the MST protocol.

clear switch tail-drop accounting

To reset the counters for tail-drop accounting, use the **clear switch tail-drop accounting** command in privileged EXEC mode.

clear switch tail-drop accounting

Syntax Description

This command has no arguments or keywords.

Command Default

None

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)MRB4	This command was introduced.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

You can use tail drop accounting to monitor packet drops on an interface or queue, on a per-class or per-port basis.

Examples

The following example shows how to use the **clear switch tail-drop accounting** command.

```
Router# clear switch tail-drop accounting
```

Related Commands

Command	Description
switch tail-drop accounting	Enables tail drop accounting on an interface or on a specific queue on an interface.

clock update-calendar

To perform a one-time update of the hardware clock (calendar) from the software clock, use the **clock update-calendar** command in user EXEC or privileged EXEC mode.

clock update-calendar

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Some platforms have a hardware clock (calendar) in addition to a software clock. The hardware clock is battery operated, and runs continuously, even if the router is powered off or rebooted.

If the software clock and hardware clock are not synchronized, and the software clock is more accurate, use this command to update the hardware clock to the correct date and time.

Examples

The following example copies the current date and time from the software clock to the hardware clock:

```
Router> clock update-calendar
```

Related Commands

Command	Description
clock read-calendar	Performs a one-time update of the software clock from the hardware clock (calendar).
ntp update-calendar	Periodically updates the hardware clock from the software clock.

connect (drop-and-insert)

To define connections among T1 or E1 controller ports for drop-and-insert (also called TDM cross-connect), use the **connect** command in global configuration mode. To restore default values, use the **no** form of this command.

connect *connection-id* {**t1** | **e1**} *slot/port-1 tdm-group-no-1* {**t1** | **e1**} *slot/port-2 tdm-group-no-2*

no connect *connection-id* {**t1** | **e1**} *slot/port-1 tdm-group-no-1* {**t1** | **e1**} *slot/port-2 tdm-group-no-2*

Syntax Description

connection-id	A name for this connection.
t1	Specifies a T1 port.
e1	Specifies an E1 port.
slot/port-1	The location of the first T1 or E1 controller to be connected. Range for *slot* and *port* is 0 and 1.
tdm-group-no-1	The number identifier of the TDM) group associated with the first T1 or E1 controller port and created by using the **tdm-group** command. Range is from 0 to 23 for T1 and from 0 to 30 for E1.
slot/port-2	The location of the second T1 or E1 controller port to be connected. Range for *slot* is from 0 to 5, depending on the platform. Range for *port* is from 0 to 3, depending on the platform and the presence of a network module.
tdm-group-no-2	The number identifier of the TDM group associated with the second T1 or E1 controller and created by using the **tdm-group** command. Range is from 0 to 23 for T1 and from 0 to 30 for E1.

Command Default

There is no drop-and-insert connection between the ports.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)XK	The command was introduced on the Cisco 2600 series and Cisco 3600 series.
12.0(7)T	This command was integrated into Cisco IOS Release 12.0(7)T.
12.1(1)T	The command was modified to accommodate two channel groups on a port for 1- and 2-port T1/E1 multiflex voice/WAN interface cards (VWICs) on the Cisco 3600 series.
15.1(1)MR	This command was integrated into Cisco IOS Release 15.1(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

The **connect** command creates a named connection between two TDM groups associated with drop-and-insert ports on T1 or E1 interfaces where you have already defined the groups by using the **tdm-group** command.

Once TDM groups are created on two different physical ports, use the **connect** command to start the passage of data between the ports. If a crosspoint switch is provided in the AIM slot, the connections can extend between ports on different cards. Otherwise, the connection is restricted to ports on the same VWIC.

The VWIC can make a connection only if the number of time slots at the source and destination are the same. For the connection to be error-free, the two ports must be driven by the same clock source; otherwise, slips occur.

Examples

The following example shows a fractional T1 terminated on port 0 using time slots 1 through 8, a fractional T1 is terminated on port 1 using time slots 2 through 12, and time slots 13 through 20 from port 0 are connected to time slots 14 through 21 on port 1 by using the **connect** command:

```
controller t1 0/0
 channel-group 1 timeslots 1-8
 tdm-group 1 timeslots 13-20
 exit
controller t1 0/1
 channel-group 1 timeslots 2-12
 tdm-group 2 timeslot 14-21
 exit
 connect exampleconnection t1 0/0 1 t1 0/1 2
```

Related Commands

Command	Description
show connect	Displays configuration information about drop-and-insert connections that have been configured on a router.
tdm-group	Configures a list of time slots for creating clear channel groups (pass-through) for TDM cross-connect.

cns config initial

To enable the Cisco Networking Services (CNS) configuration agent and initiate a download of the initial configuration, use the **cns config initial** command in global configuration mode. To remove an existing **cns config initial** command from the running configuration of the routing device, use the **no** form of this command.

cns config initial {*host-name* | *ip-address*} [**encrypt**] [*port-number*] [**page** *page*] [**syntax-check**] [**no-persist**] [**source** *interface name*] [**status** *url*] [**event**] [**inventory**]

no cns config initial

Syntax Description

host-name	Hostname of the configuration server.
ip-address	IP address of the configuration server.
encrypt	(Optional) Uses a Secure Sockets Layer (SSL) encrypted link to the event gateway.
port-number	(Optional) Port number of the configuration service. The value is from 0 to 65535. The default is 80 with no encryption and 443 with encryption.
page	(Optional) Indicates that the configuration is located on a web page.
page	(Optional) Web page where the configuration is located. The default is /cns/config.asp.
syntax-check	(Optional) Turns on syntax checking.
no-persist	(Optional) Suppresses the default automatic writing to NVRAM of the configuration pulled as a result of issuing the **cns config initial** command. If not present, issuing the **cns config initial** command causes the resultant configuration to be automatically written to NVRAM.
source	(Optional) Specifies the source of CNS communications.
interface name	(Optional) Interface name of the source of CNS communications.
status *url*	(Optional) Sends an event to the specified URL via HTTP, either notifying successful completion of the configuration or warning that the configuration contained errors.
event	(Optional) Sends an event to the Event Bus notifying successful completion of the configuration or warning that the configuration contained errors. If the CNS event agent is not configured, the event will be saved until the CNS event agent is enabled. If the **event** keyword is not specified, a log message is sent to the console of the device after the configuration is complete.
inventory	(Optional) Sends an inventory of the line cards and modules in the router to the CNS configuration engine as part of the HTTP request.

Defaults

The port number defaults to 80 with no encryption and 443 with encryption.
Default web page of the initial configuration is /cns/config.asp.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(18)ST	This command was integrated into Cisco IOS Release 12.0(18)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.2(2)XB	This command was implemented on Cisco IAD2420 series Integrated Access Devices (IADs).
12.2(8)T	The **source** and **encrypt** keywords were added.
12.3(1)	The **inventory** keyword was added.
12.3(8)T	The **status** *url* keyword/argument pair was added.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command when a basic configuration—called a bootstrap configuration—is added to multiple routers before being deployed. When a router is initially powered (or each time a router is reloaded when the **no-persist** keyword is used) the **cns config initial** command will cause a configuration file—called an initial configuration—for the router to be downloaded from the configuration server. The initial configuration can be unique for each router.

When the configuration has been received by the router, each line of the configuration will be applied in the same order as it was received. If the Cisco IOS parser has an error with one of the lines of the configuration, then all the configuration up to this point will be applied to the router, but none of the configuration beyond the error will be applied. If an error occurs, the command will retry until it successfully completes. Once the configuration has successfully completed the **cns config initial** command will be removed from the running configuration. By default, NVRAM will be updated except when the **no-persist** keyword is configured.

When this command is used with the **event** keyword, a single message will be published on the event bus after the configuration is complete. The event bus will display one of the following status messages:

- cisco.mgmt.cns.config.complete—CNS configuration agent successfully applied the initial configuration.
- cisco.mgmt.cns.config.warning—CNS configuration agent fully applied the initial configuration but encountered possible semantic errors.

When this command is used with the **status** keyword, a single message will be published to the URL specified after the configuration is complete.

Examples

The following example shows how to enable the CNS configuration agent and initiate an initial configuration:

```
Router(config)# cns config initial 10.19.4.5
```

Related Commands

Command	Description
cns config connect-intf	Specifies the interface for connecting to the CNS configuration engine.
cns config notify	Detects CNS configuration changes and sends an event containing the previous and current configuration.
cns config retrieve	Enables the CNS configuration agent and initiates a download of the initial configuration.
cns event	Configures the CNS event gateway, which provides CNS event services to Cisco IOS clients.
show cns config status	Displays information about the status of the CNS configuration agent.

cns config partial

To start the Cisco Networking Services (CNS) configuration agent and accept a partial configuration, use the **cns config partial** command in global configuration mode. To shut down the CNS partial configuration agent, use the **no** form of this command.

cns config partial {*host-name* | *ip-address*} [**encrypt**] [*port-number*] [**source** *interface name*] [**inventory**]

no cns config partial

Syntax Description

host-name	Hostname of the configuration server.
ip-address	IP address of the configuration server.
encrypt	(Optional) Uses a Secure Sockets Layer (SSL) encrypted link between the router and the web server.
port-number	(Optional) Port number of the configuration service. The value is from 0 to 65535. The default is 80 with no encryption and 443 with encryption.
source	(Optional) Specifies the source of this device.
interface name	(Optional) Interface name to use as the source of this device.
inventory	(Optional) Sends an inventory of the line cards and modules in the router to the CNS configuration engine as part of the HTTP request.

Command Default

The CNS configuration agent is not enabled to accept a partial configuration and the router does not request or receive updates.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(18)ST	This command was integrated into Cisco IOS Release 12.0(18)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.2(2)XB	This command was implemented on Cisco IAD2420 series Integrated Access Devices (IADs).
12.2(8)T	The **source** keyword and **encrypt** arguments were added.
12.3(1)	The **inventory** keyword was added.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.4(4)T	This command was modified to include enhanced CNS error messages.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command to start the CNS partial configuration agent. You must enable the CNS event agent using the **cns event** command before configuring this command. The CNS event agent sends an event with the subject "cisco.mgmt.cns.config.load" to specify whether configuration data can be pushed to the CNS partial configuration agent or pulled from a configuration server by the CNS partial configuration agent.

In the push model, the event message delivers the configuration data to the partial configuration agent.

In the pull model, the event message triggers the partial configuration agent to pull the configuration data from the CNS configuration engine. The event message contains information about the CNS configuration engine, not the actual configuration data. The host name or IP address is the address of the CNS configuration engine from which the configuration is pulled. Use the **cns trusted-server** command to specify which CNS configuration engines can be used by the CNS partial configuration agent.

When the configuration has been received by the router, each line of the configuration will be applied in the same order as it was received. If the Cisco IOS parser has an error with one of the lines of the configuration, then all the configuration up to this point will be applied to the router, but none of the configuration beyond the error will be applied. If an error occurs, the command will retry until the configuration successfully completes. In the pull mode, the command will not retry after an error. By default, NVRAM will be updated except when the **no-persist** keyword is configured.

A message will be published on the CNS event bus after the partial configuration is complete. The CNS event bus will display one of the following status messages:

- cisco.mgmt.cns.config.complete—CNS configuration agent successfully applied the partial configuration.
- cisco.mgmt.cns.config.warning—CNS configuration agent fully applied the partial configuration, but encountered possible semantic errors.
- cisco.mgmt.cns.config.failure(CLI syntax)—CNS configuration agent encountered a command line interface (CLI) syntax error and was not able to apply the partial configuration.
- cisco.mgmt.cns.config.failure(CLI semantic)—CNS configuration agent encountered a CLI semantic error and was not able to apply the partial configuration.

Examples

The following example shows how to configure the CNS partial configuration agent to accept events from the event gateway at 172.28.129.22. The CNS partial configuration agent will connect to the CNS configuration server at 172.28.129.22, port number 80. The CNS partial configuration agent requests are redirected to a configuration server at 172.28.129.40, port number 80.

```
Router(config)# cns event 172.28.129.22
Router(config)# cns trusted-server config 172.28.129.40
Router(config)# cns config partial 172.28.129.22
```

The following example shows an enhanced error message sent to the subject "cisco.mgmt.cns.config.results":

```
[2005-09-08 14:30:44]: subject=cisco.mgmt.cns.config.results.dvlpr-7200-6, message=
<?xml version="1.0" encoding="UTF-8"?>
<SOAP:Envelope xmlns:SOAP="http://www.w3.org/2003/05/soap-envelope">
```

```
<SOAP:Header>
<wsse:Security xmlns:wsse="http://schemas.xmlsoap.org/ws/2002/04/secext"
SOAP:mustUnderstand="true">
<wsse:UsernameToken>
<wsse:Username>user1</wsse:Username>
<wsse:Password>password1</wsse:Password>
</wsse:UsernameToken>
</wsse:Security>
<CNS:cnsHeader Version="2.0" xmlns:CNS="http://www.cisco.com/management/cns/envelope">
<CNS:Agent>CNS_CONFIG</CNS:Agent>
<CNS:Response>
<CNS:correlationID>SOAP_IDENTIFIER</CNS:correlationID>
</CNS:Response>
<CNS:Time>2005-09-13T08:34:36.523Z</CNS:Time>
</CNS:cnsHeader>
</SOAP:Header>
<SOAP:Body xmlns="http://www.cisco.com/management/cns/config">
<configResults version="2.0" overall="Success">
<configId>AAA</configId>
</configResults>
</SOAP:Body>
</SOAP:Envelope>
```

Related Commands

Command	Description
cns config initial	Starts the CNS configuration agent and initiates an initial configuration.
cns event	Enables and configures CNS event agent services.
cns trusted-server	Specifies a trusted server for CNS agents.
show cns config outstanding	Displays information about incremental CNS configurations that have started but are not yet completed.

cns config retrieve

To enable the Cisco Networking Services (CNS) configuration agent and initiate a download of the initial configuration, use the **cns config retrieve** command in privileged EXEC mode.

cns config retrieve {*host-name* | *ip-address*} [**encrypt**] [*port-number*] [**page** *page*] [**overwrite-startup**] [**retry** *retries* **interval** *seconds*] [**syntax-check**] [**no-persist**] [**source** *interface name*] [**status** *url*] [**event**] [**inventory**]

Syntax Description

host-name	Hostname of the configuration server.
ip-address	IP address of the configuration server.
encrypt	(Optional) Uses a Secure Sockets Layer (SSL) encrypted link to the event gateway.
port-number	(Optional) Port number of the configuration service. The value is from 0 to 65535. The default is 80 with no encryption and 443 with encryption.
page	(Optional) Indicates that the configuration is located on a web page.
page	(Optional) Web page where the configuration is located. The default is /cns/config.asp.
overwrite-startup	(Optional) Replaces the startup configuration file. Does not apply to the running configuration file.
retry *retries*	(Optional) Specifies the retry interval. The range is 0 to 100. The default is 0.
interval *seconds*	(Optional) Specifies the time in seconds, before the next attempt to request the configuration of a device from a configuration server. The range is 1 to 3600.
syntax-check	(Optional) Turns on syntax checking.
no-persist	(Optional) Suppresses the default automatic writing to NVRAM of the configuration pulled as a result of issuing the **cns config retrieve** command. If not present, issuing the **cns config retrieve** command causes the resultant configuration to be automatically written to NVRAM.
source	(Optional) Specifies the source of CNS communications.
interface name	(Optional) Interface name of the source of the configuration.
status *url*	(Optional) Sends the configuration the specified URL via HTTP, either notifying successful completion of the configuration or warning that the configuration contained errors.
event	(Optional) Sends an event to the CNS Event Bus stating successful completion of the configuration, a warning that the configuration contained errors, or a message noting that the configuration failed. If the CNS event agent is not configured, the event will be saved until the CNS event agent is enabled. If the **event** keyword is not specified, a log message is sent to the console of the device after the configuration is complete.
inventory	(Optional) Sends an inventory of the line cards and modules in the router to the CNS configuration engine as part of the HTTP request.

Defaults

The port number defaults to 80 with no encryption and 443 with encryption.
Default web page of the initial configuration is /cns/config.asp.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(18)ST	This command was integrated into Cisco IOS Release 12.0(18)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.3(1)	The **inventory** keyword was added.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(15)T	The **retry** *retries* and **interval** *seconds* keywords and arguments were added.
12.2(33)SRC	This command was integrated into Cisco IOS Release 12.2(33)SRC.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was incorporated.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command to request the configuration of a device from a configuration server. Use the **cns trusted-server** command to specify which configuration server can be used (trusted).

When the configuration has been received by the router, each line of the configuration will be applied in the same order as it was received. If the Cisco IOS parser has an error with one of the lines of the configuration, then all the configuration up to this point will be applied to the router, but none of the configuration beyond the error will be applied. If an error occurs, the command will not retry.

A single message will be published on the event bus after the partial configuration is complete. The event bus will display one of the following status messages:

- cisco.mgmt.cns.config.complete—CNS configuration agent successfully applied the configuration.
- cisco.mgmt.cns.config.warning—CNS configuration agent fully applied the configuration, but encountered possible semantic errors.
- cisco.mgmt.cns.config.failure—CNS configuration agent encountered an error and was not able to apply the configuration.

The **cns config retrieve** command can be used with Command Scheduler commands (for example, **kron policy-list** and **cli** commands) in environments where it is not practical to use the CNS event agent and the **cns config partial** command. Configured within the **cli** command, the **cns config retrieve** command can be used to poll the configuration server to detect configuration changes.

You can use the optional **retry** and **interval** keywords to specify an amount of time in seconds to wait before attempting to retrieve a configuration from a trusted server. The number of retries is restricted to 100 to prevent the configuration agent from indefinitely attempting to reach an unreachable server. Use the keyboard combination **Ctrl-Shift-6** to abort this command.

Examples

The following example shows how to request a configuration from a trusted server at 10.1.1.1:

```
Router(config)# cns trusted-server all 10.1.1.1
Router(config)# exit
Router# cns config retrieve 10.1.1.1
```

The following example shows how to request a configuration from a trusted server at 10.1.1.1 and to configure a CNS configuration retrieve interval:

```
Router(config)# cns trusted-server all 10.1.1.1
Router(config)# exit
Router# cns config retrieve 10.1.1.1 retry 50 interval 1500
CNS Config Retrieve Attempt 1 out of 50 is in progress
Next cns config retrieve retry is in 1499 seconds (Ctrl-Shft-6 to abort this command).
..
00:26:40: %CNS-3-TRANSPORT: CNS_HTTP_CONNECTION_FAILED:10.1.1.1 -Process= "CNS config
retv", ipl= 0, pid= 43
00:26:40: %CNS-3-TRANSPORT: CNS_HTTP_CONNECTION_FAILED -Process= "CNS config retv", ipl=
0, pid= 43......
```

Related Commands

Command	Description
cli	Specifies EXEC CLI commands within a Command Scheduler policy list.
cns config initial	Starts the CNS configuration agent and initiates an initial configuration.
cns trusted-server	Specifies a trusted server for CNS agents.
kron policy-list	Specifies a name for a Command Scheduler policy and enters kron-policy configuration mode.
show cns config status	Displays information about the status of the CNS configuration agent.

cns event

To configure the Cisco Networking Services (CNS) event gateway, which provides CNS event services to Cisco IOS clients, use the **cns event** command in global configuration mode. To remove the specified event gateway from the gateway list, use the **no** form of this command.

cns event {*host-name* | *ip-address*} [**encrypt**] [*port-number*] [**backup**] [**failover-time** *seconds*] [**keepalive** *seconds retry-count*] [**source** *interface-name*] [**clock-timeout** *time*] [**reconnect** *time*]

no cns event [*host-name* | *ip-address*] [*port-number*] [**encrypt**] [**backup**] [**failover-time** *seconds*] [**keepalive** *seconds retry-count*] [**source** *interface name*] [**clock-timeout** *time*] [**reconnect** *time*]

Syntax Description

host-name	Hostname of the event gateway.
ip-address	IP address of the event gateway.
encrypt	(Optional) Uses a Secure Sockets Layer (SSL) encrypted link to the event gateway. **Note** This keyword is available only in images that support SSL.
port-number	(Optional) Port number for the event gateway. • Valid range is from 0 to 65535. The default is 11011 with no encryption or 11012 with encryption.
backup	(Optional) Indicates a backup gateway. • If omitted, indicates the primary gateway. A primary gateway must be configured before you can configure a backup gateway. Optional keywords, if omitted, are set as for the primary gateway.
failover-time *seconds*	(Optional) Specifies a time interval, in seconds, to wait for the primary gateway route after the route to the backup gateway is established. • Valid range is from 0 to 65535. The default is 3.
keepalive *seconds retry-count*	(Optional) Specifies a keepalive timeout, in seconds, and retry count.
source *interface-name*	(Optional) Indicates the interface name of the source for CNS communications.
clock-timeout *time*	(Optional) Specifies the maximum time, in minutes, that the CNS event agent will wait for the clock to be set for transports (such as SSL) that require an accurate clock. The default is 10.
reconnect *time*	(Optional) Specifies the configurable upper limit of the maximum retry timeout, in seconds. • The valid range is from 1 to 65535. The default is 3600.

Command Default

No CNS event gateway is configured.

Command Modes Global configuration (config)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(18)ST	This command was integrated into the Cisco IOS Release 12.0(18)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.2(2)XB	This command was implemented on Cisco IAD2420 series Integrated Access Devices (IADs).
12.2(8)T	The **encrypt**, **init-retry**, **source**, and **force-fmt1** keywords were added.
12.3	The **reconnect-time** keyword was added.
12.3(1)	The **init-retry** keyword was replaced with the **failover-time** keyword. The **force-fmt1** keyword was removed. The **clock-timeout** keyword was added.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines The CNS event agent must be enabled before any of the other CNS agents are configured because the CNS event agent provides a transport connection to the CNS event bus for all other CNS agents. The other CNS agents use the connection to the CNS event bus to send and receive messages. The CNS event agent does not read or modify the messages.

The **failover-time** keyword is useful if you have a backup CNS event gateway configured. If the CNS event agent is trying to connect to the gateway and it discovers that the route to the backup is available before the route to the primary gateway, the *seconds* argument specifies how long the CNS event agent will continue to search for a route to the primary gateway before attempting to link to the backup gateway.

Unless you are using a bandwidth-constrained link, you should set a keepalive timeout and retry count. Doing so allows the management network to recover gracefully should a Cisco IE2100 configuration engine ever fail. Without the keepalive data, such a failure requires manual intervention on every device. The value of the *seconds* argument multiplied by the value of the *retry-count* argument determines the length of idle time before the CNS event agent will disconnect and attempt to reconnect to the gateway. We recommend a minimum *retry-count* of two.

If the optional **source** keyword is used, the source IP address might be a secondary IP address of a specific interface to allow a management network to run on top of a production network.

If network connectivity between the Cisco IOS router running the CNS event agent and the gateway is absent, the event agent goes into an exponential backoff retry mode and gets stuck at the maximum limit (which may be hours). The **reconnect-time** keyword allows a configurable upper limit of the maximum retry timeout.

If you configure CNS passwords using the **cns password** command, existing event connections will be closed and reopened.

Examples

The following example shows how to set the address of the primary CNS event gateway to the configuration engine software running on IP address 10.1.2.3, port 11011, with a keepalive of 60 seconds and a retry count of 5:

```
Router(config)# cns event 10.1.2.3 11011 keepalive 60 5
```

Related Commands

Command	Description
cns id	Sets the unique event ID, config ID, or image ID used by CNS services.
cns password	Configures a CNS password.
show cns event status	Displays status information about the CNS event agent.

cns exec

To enable and configure the Cisco Networking Services (CNS) exec agent, which provides CNS exec agent services to Cisco IOS clients, use the **cns exec** command in global configuration mode. To disable the use of CNS exec agent services, use the **no** form of this command.

cns exec [*host-name* | *ip-address*] [**encrypt** [*enc-port-number*]] [*port-number*] [**source** *interface name*]

no cns exec [*host-name* | *ip-address*] [**encrypt** [*enc-port-number*]] [*port-number*] [**source** *interface name*]

Syntax Description

host-name	(Optional) Hostname of the exec server.
ip-address	(Optional) IP address of the exec server.
encrypt	(Optional) Uses a Secure Sockets Layer (SSL) encrypted link to the exec agent server. **Note** This keyword is available only in images that support SSL.
enc-port-number	(Optional) Port number for the encrypted exec server. The default is 443.
port-number	(Optional) Port number for the exec server. The default is 80.
source	(Optional) Specifies the use of an IP address defined by the *ip-address* argument as the source for CNS exec agent communications.
interface name	(Optional) Interface name.

Defaults

No CNS exec agent is configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

The CNS exec agent allows a remote application to execute an EXEC mode command-line interface (CLI) command on a Cisco IOS device by sending an event message containing the command. A restricted set of EXEC CLI commands—**show** commands—are supported.

In previous Cisco IOS releases, the CNS exec agent was enabled when the CNS configuration agent was enabled through the **cns config partial** command.

Examples

The following example shows how to enable the CNS exec agent with an IP address of 10.1.2.3 for the exec agent server, a port number of 93, and a source IP address of 172.17.2.2:

```
Router(config)# cns exec 10.1.2.3 93 source 172.17.2.2
```

Related Commands

Command	Description
cns event	Enables and configures CNS event agent services.
show cns event subject	Displays a list of CNS event agent subjects that are subscribed to by applications.

cns id

To set the unique event ID, config ID, or image ID used by Cisco Networking Services (CNS), use the **cns id** command in global configuration mode. To set the identifier to the hostname of the Cisco IOS device, use the **no** form of this command.

If ID Choice Is an IP Address or MAC Address

cns id *type number* {**ipaddress** | **mac-address**} [**event** | **image**]

no cns id *type number* {**ipaddress** | **mac-address**} [**event** | **image**]

If ID Choice Is Anything Else

cns id {**hardware-serial** | **hostname** | **string** *string* | **udi**} [**event** | **image**]

no cns id {**hardware-serial** | **hostname** | **string** *string* | **udi**} [**event** | **image**]

Syntax Description

type number	Type of interface (for example, **ethernet**, **group-async**, **loopback**, or **virtual-template**) and the interface number. • Indicates from which interface the IP or MAC address should be retrieved in order to define the unique ID.
ipaddress	Uses the IP address specified in the *type number* arguments as the unique ID.
mac-address	Uses the MAC address specified in the *type number* arguments as the unique ID.
event	(Optional) Sets this ID to be the event ID value, which is used to identify the Cisco IOS device for CNS event services. • If both optional keywords are omitted, the event ID is set to the hostname of the Cisco IOS device.
image	(Optional) Sets this ID to be the image ID value, which is used to identify the Cisco IOS device for CNS image agent services. • If both optional keywords are omitted, the image ID is set to the hostname of the Cisco IOS device.
hardware-serial	Uses the hardware serial number as the unique ID.
hostname	Uses the hostname as the unique ID. This is the system default.
string *string*	Uses an arbitrary text string—typically the hostname—as the unique ID.
udi	Uses the product Unique Device Identifier (UDI) as the unique ID.

Command Default

The system defaults to the hostname of the Cisco IOS device as the unique ID.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(2)XB	This command was introduced on Cisco IAD2420 series IADs.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T. The **dns-reverse** keyword was removed.
12.3(1)	The optional **image** keyword was added to set an image ID.
12.3(14)T	The **udi** keyword was added to use the product UDI as the unique ID.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command to set the unique ID to the CNS configuration agent, which then pulls the initial configuration template to the Cisco IOS device during bootup.

You can set one or all three IDs: the config ID value for CNS configuration services, the event ID value for CNS event services, and the image ID value for CNS image agent services. To set all values, use the command three times.

To set the CNS event ID to the host name of the Cisco IOS device, use the **no** form of this command with the **event** keyword. To set the CNS config ID to the host name of the Cisco IOS device, use the **no** form of this command without the **event** keyword. To set the CNS image ID to the host name of the Cisco IOS device, use the **no** form of this command with the **image** keyword.

Unique Device Identifier

Each identifiable Cisco product is an entity, as defined by the Entity MIB (RFC-2737) and its supporting documents. Some entities, such as a chassis, will have subentities like slots. An Ethernet switch might be a member of a superentity, such as a stack. Most Cisco entities that are orderable products will leave the factory with an assigned UDI. The UDI information is printed on a label that is affixed to the physical hardware device, and it is also stored electronically on the device in order to facilitate remote retrieval. To use UDI retrieval, the Cisco product in use must be UDI-enabled.

A UDI consists of the following elements:

- Product identifier (PID)
- Version identifier (VID)
- Serial number (SN)

The PID is the name by which a product can be ordered; historically, it has been called the “Product Name” or “Part Number.” This identifier is the one to use to order an exact replacement part.

The VID is the version of the product. When a product is revised, the VID is incremented according to a rigorous process derived from Telcordia GR-209-CORE, an industry guideline that governs product change notices.

The SN is the vendor-unique serialization of the product. Each manufactured product carries a unique serial number assigned at the factory, which cannot be changed in the field. The serial number is used to identify an individual, specific instance of a product.

Note The **udi** keyword will create an ID consisting of the PID, VID, and SN values. Any spaces in PID, VID and SN values will be removed. To view the UDI for this product, use the **show inventory** command. This keyword is not available in Cisco IOS Release 12.2(33)SRA.

Examples

The following example shows how to pass the hostname of the Cisco IOS device as the config ID value:

```
Router(config)# cns id hostname
```

The following example shows how to pass the hardware serial number of the Cisco IOS device as the event ID value:

```
Router(config)# cns id hardware-serial event
```

The following example shows how to pass the UDI as the event ID value:

```
Router(config)# cns id udi event
```

The following example shows how to pass the IP address of Ethernet interface 0/1 as the image ID value:

```
Router(config)# cns id ethernet 0/1 image
```

Related Commands

Command	Description
cns event	Enables the CNS event gateway, which provides CNS event services to Cisco IOS clients.
cns image	Enables the CNS image agent services to Cisco IOS clients.
show inventory	Displays the product inventory listing for all Cisco products that are installed in a networking device.

cns image password

To configure a password to use with the Cisco Networking Services (CNS) image agent services, use the **cns image password** command in global configuration mode. To disable the use of a password, use the **no** form of this command.

cns image password *image-password*

no cns image password *image-password*

Syntax Description

image-password	Password to be used for CNS image agent services.

Command Default

No password is used with the CNS image agent services.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command to create a password that is sent with the image ID in all CNS image agent messages. The recipient of these messages can use this information to authenticate the sending device. This password may be different from the username and password used for HTTP basic authentication configured with other CNS image agent commands.

Examples

The following example shows how to configure a password to be used for the CNS image agent services:

```
Router(config)# cns image password textabc
```

Related Commands

Command	Description
cns id	Sets the unique event ID, config ID, or image ID used by CNS services.

cns image retrieve

To contact a Cisco Networking Services (CNS) image distribution server and download a new image if a new image exists, use the **cns image retrieve** command in privileged EXEC mode.

cns image retrieve [**server** *server-url* [**status** *status-url*]]

Syntax Description

server	(Optional) Specifies an image distribution server to contact for information about an updated image to be downloaded.
server-url	(Optional) URL used to contact an image distribution server.
status	(Optional) Specifies that any status messages generated by this command will be sent to the URL specified by the *status-url* argument.
status-url	(Optional) URL of a web server to which status messages are written.

Command Default

An error occurs when a cns image server has not previously been configured in global configuration mode.

Usage Guidelines

When the **cns image retrieve** command is issued in privileged EXEC mode without the **server** keyword and *server-url* argument, an error occurs.

When a cns image server has been configured and the **cns image retrieve** command is issued with no **server** keyword and *server-url* argument, the server path configured in the **cns image** command is used.

When the **cns image** command is issued in global configuration mode with the optional **server** keyword, no keywords are required and no error occurs when you issue the **cns image retrieve** command in privileged EXEC mode.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

You must enable the CNS image agent services using the **cns image** command before configuring this command.

Use this command to poll an image distribution server and download a new image to the Cisco IOS device if a new image exists.

Examples

The following example shows how to configure the CNS image agent to access the image distribution server at 10.19.2.3 and download a new image if a new image exists:

```
Router# cns image retrieve server https://10.20.2.3:8080/cns/imageserver/ status
https://10.20.2.3:8080/cns/imageserver/messages/
```

Related Commands

Command	Description
cns image	Enables CNS image agent services.
cns trusted-server	Specifies a trusted server for CNS agents.
show cns image status	Displays information about the CNS image agent status.

cns inventory

To enable the CNS inventory agent—that is, to send an inventory of the router's line cards and modules to the CNS configuration engine—and enter CNS inventory mode, use the **cns inventory** command in global configuration mode. To disable the CNS inventory agent, use the **no** form of this command.

cns inventory

no cns inventory

Syntax Description

This command has no arguments or keywords.

Command Default

The CNS inventory agent is disabled.

Command Modes

Global configuration

Command History

Release	Modification
12.2(8)T	This command was introduced.
12.3(1)	The **config**, **event**, and **notify oir** keywords were removed.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use this command with the **announce config** and **transport event** CNS inventory configuration mode commands to specify when to notify the CNS configuration engine of changes to the router's port-adaptor and interface inventory. A transport must be specified in CNS inventory configuration mode before any of the CNS inventory commands are executed.

Examples

The following example shows how to enable the CNS inventory agent and enter CNS inventory configuration mode:

```
Router(config)# cns inventory
Router(cns_inv)#
```

Related Commands

Command	Description
cns config initial	Starts the CNS configuration agent and initiates an initial configuration.

cns password

To configure a Cisco Networking Services (CNS) password, use the **cns password** command in global configuration mode. To disable the CNS password, use the **no** form of this command.

cns password *password*

no cns password *password*

Syntax Description

password	Any character string that specifies the CNS password.

Command Default

A CNS password is not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.4(8)T	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

You must configure the CNS password the first time a router is deployed, and the CNS password must be the same as the bootstrap password set on the Configuration Engine (CE). If both the router and the CE bootstrap password use their default settings, a newly deployed router will be able to connect to the CE.

Once connected, the CE will change the CNS password from the bootstrap password to a random password. Network administrators must ensure not to change the CNS password. If the CNS password is changed, connectivity to the CE will be lost.

Examples

The following example shows how to set a CNS password named password1:

```
Router(config)# cns password password1
```

Related Commands

Command	Description
cns id	Sets a unique event ID, config ID, or image ID used by CNS services.

cns template connect

To enter Cisco Networking Services (CNS) template connect configuration mode and define the name of a CNS connect template, use the **cns template connect** command in global configuration mode. To disable the CNS connect template, use the **no** form of this command.

cns template connect *name*

no cns template connect *name*

Syntax Description

name	Name of the CNS connect template to be configured.

Command Default

No CNS connect templates are defined.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.3(2)XF	This command was introduced.
12.3(8)T	This command was integrated into Cisco IOS Release 12.3(8)T.
12.3(9)	This command was integrated into Cisco IOS Release 12.3(9).
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use the **cns template connect** command to enter CNS template connect configuration mode and define the name of the CNS connect template to be configured. Then use the **cli** command to specify the command lines of the CNS connect template.



Note When you create a CNS connect template, you must enter the **exit** command to complete the configuration of the template and exit from CNS template connect configuration mode. This requirement was implemented to prevent accidentally entering a command without the **cli** command.

Examples

The following example shows how to configure a CNS connect template named template1:

```
Router(config)# cns template connect template1
Router(config-templ-conn)# cli command-1
```

```
Router(config-templ-conn)# cli command-2
Router(config-templ-conn)# cli no command-3
Router(config-templ-conn)# exit
Router(config)#
```

When the template1 template is applied, the following commands are sent to the router's parser:

```
command-1
command-2
no command-3
```

When the template1 template is removed from the router's configuration after an unsuccessful ping attempt to the CNS configuration engine, the following commands are sent to the router's parser:

```
no command-1
no command-2
command-3
```

Related Commands

Command	Description
cli (cns)	Specifies the command lines of a CNS connect template.
cns connect	Enters CNS connect configuration mode and defines the parameters of a CNS connect profile for connecting to the CNS configuration engine.
discover (cns)	Defines the interface parameters within a CNS connect profile for connecting to the CNS configuration engine.
template (cns)	Specifies a list of CNS connect templates within a CNS connect profile to be applied to a router's configuration.

cns trusted-server

To specify a trusted server for Cisco Networking Services (CNS) agents, use the **cns trusted-server** command in global configuration mode. To disable the use of a trusted server for a CNS agent, use the **no** form of this command.

cns trusted-server {**all-agents** | **config** | **event** | **exec** | **image**} *name*

no cns trusted-server {**all-agents** | **config** | **event** | **exec** | **image**} *name*

Syntax Description

all-agents	Specifies a trusted server for all CNS agents.
config	Specifies a trusted server for CNS config agent.
event	Specifies a trusted server for CNS event agent.
exec	Specifies a trusted server for CNS exec agent.
image	Specifies a trusted server for CNS image agent.
name	A string that specifies the hostname or IP address of the trusted server.

Defaults

By default, only the implicit server strings are trusted.

The configuration of the CNS event agent's server string through the command-line interface (CLI) results in an implicit trust by all CNS agents. For the other CNS agents, the configuration of a server string using the CLI results in an implicit trust of the server for the specified agent. For example, **cns exec 10.2.1.2** implies the string 10.2.1.2 is implicitly trusted by the exec agent, and specifying **cns event 10.4.2.2** implies the string 10.4.2.2 is implicitly trusted by all the CNS agents.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use the **cns trusted-server** command to specify a trusted server for an individual CNS agent or all the CNS agents. In previous Cisco IOS Releases, CNS agents could connect to any server and this could expose the system to security violations. An attempt to connect to a server not on the list results in an

error message being displayed and an authentication failure reply extensible markup language (XML). For backwards compatibility the configuration of a server address using the configuration CLI for a CNS agent results in an implicit trust of the server for the specified agent.

Use this command when a CNS agent will redirect its response to a server address that is not explicitly configured on the command line for the specific CNS agent. For example, the CNS exec agent may have one server configured but receive a message from the CNS Event Bus that overrides the configured server. The new server address string has not been explicitly configured so the new server address is not a trusted server. An error will be generated when the CNS exec agent tries to respond to this new server address unless the **cns trusted-server** command has been configured for the new server address string.

The **cns trusted-server** command does not use Domain Name System (DNS). Instead a string comparison is done between the configured and implicit trusted servers and requested redirected server address.

Examples

The following example shows how to configure server 10.19.2.5 as a trusted server for the CNS event agent:

```
Router# cns trusted-server event 10.19.2.5
```

The following example shows how to configure server 10.2.2.8, which maps though DNS to host.somedomain.com as a trusted server for all CNS agents:

```
Router# cns trusted-server all-agents 10.2.2.8
Router# cns trusted-server all-agents host
Router# cns trusted-server all-agents host.somedomain.com
```

The following example shows how to configure the string 10.2.2.8 as an implicit trusted server for the CNS image agent:

```
Router# cns image server 10.2.2.8 status 10.2.2.8
```

Related Commands

Command	Description
cns config	Configures CNS configuration agent services.
cns event	Enables and configures CNS event agent services.
cns image	Configures CNS image agent services.

continuity-check

To enable the transmission of continuity check messages (CCMs) for a maintenance association, use the **continuity-check** command in Ethernet connectivity fault management (CFM) service configuration mode. To disable message transmission, use the **no** form of this command.

continuity-check [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]

no continuity-check [**interval** *time* | **loss-threshold** | **static rmep**]

Syntax Description

interval	(Optional) Configures the time period between message transmissions.
time	(Optional) Time period between message transmissions. Valid values are as follows: • 100ms—100 milliseconds • 10m—10 minutes • 10s—10 seconds • 1m—1 minute • 1s—1 second • 3.3ms—3.3 milliseconds The values supported are platform dependent. **Note** A 10ms interval is not currently supported.
loss-threshold	(Optional) Sets the number of CCMs that should be missed before declaring that a remote maintenance endpoint (MEP) is down.
threshold	(Optional) Integer from 2 to 255. The default is 3.
static	(Optional) Verifies that the MEP received in the CCM is valid.
rmep	(Optional) MEP defined using the **mep mpid** command.

Command Default

CCMs are not transmitted.

Command Modes

Ethernet CFM service configuration (config-ecfm-srv)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

The static MEP list configured using the **mep mpid** command is used to verify whether a MEP received in a CCM is valid. If the MEP in the received CCM is not configured in the MEP list, an error CCM received fault alarm is set.

Output of the **show running all** command displays "continuity-check interval 1s" when the default interval period is configured and "continuity-check loss-threshold 3" when the default loss threshold is configured.

Examples

The following example shows how to configure a loss threshold of 50 CCMs:

```
Router(config)# ethernet cfm domain operatorA level 5
Router(config-ecfm)# service vlan-id 10 port
Router(config-ecfm-srv)# continuity-check loss-threshold 50
Router(config-ecfm-srv)#
```

Related Commands

Command	Description
mep mpid	Statically defines MEPs within a maintenance association.
show running all	Shows the running configuration with default values.

controller

To configure a T1, E1, or BITS controller and enter controller configuration mode, use the **controller** command in global configuration mode.

controller {**bits** | **t1** | **e1** | **shdsl**} *slot/port/subslot number/port number*

Syntax Description

bits	BITS controller
t1	T1 controller.
e1	E1 controller.
shdsl	SHDSL controller.
slot/*port*	Backplane slot number and port number on the interface. Refer to your hardware installation manual for the specific values and slot numbers.
subslot number	Defines the subslot on the router in which the HWIC is installed.
port	Port number of the controller. Valid numbers are 0 and 1. The slash mark (*/*) is required between the *slot* argument and the *port* argument.

Defaults

No T1 or E1 controller is configured.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The e1 keyword was added.
12.0(3)T	Support was added for dial shelves on Cisco AS5800 access servers.
12.2(7)XO	The j1 keyword was added for the Cisco 2600 and Cisco 3600 series.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(19)MR2	This command was integrated into Cisco IOS Release12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command is used in configurations where the router or access server is intended to communicate with a T1 or E1 fractional data line. Additional parameters for the T1 or E1 line must be configured for the controller before the T1 or E1 circuits can be configured by means of the **interface** global configuration command.

To view the status of the controllers use the **show controllers** command.

Examples

The following example configures slot 0, port 2 of the router as an E1 controller:

```
Router# configure terminal
Router(config)# controller e1 0/2
Router(config-controller)#
```

Related Commands

Command	Description
controllers shdsl	Enters configuration mode for the SHDSL controller.
show controllers e1	Displays information about the E1 controller.
show controllers t1	Displays the total number of calls and call durations on a T1 controller.

controller shdsl

To configure a controller for single-pair high-bit-rate digital subscriber line (SHDSL) mode, use the **controller shdsl** command in global or controller configuration mode.

controller shdsl *slot-number/subslot-number/port-number*

Syntax Description

number	Controller number. The valid controller number is 0.
slot-number/	Defines the slot on the router in which the high-speed WAN interface cards (HWIC) is installed.
subslot-number/	Defines the subslot on the router in which the HWIC is installed.
port-number	Defines the port on the router in which the HWIC is installed. By default, Cisco HWIC-4SHDSL and HWIC-2SHDSL use port number 0.

Defaults

Controller number: 0

Command Modes

Cisco HWIC-4SHDSL

Global configuration

Controller configuration

Command History

Release	Modification
11.3(5)AAA	This command was introduced.
12.2(8)T	This command was implemented on Cisco IAD2420 series IADs.
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router, and on the Cisco 2800 and 3800 series access routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command is used to configure the controller mode and the controller number.

Examples

Cisco HWIC-4SHDSL

The following example uses the **controller shdsl** command to configure a Cisco HWIC-4SHDSL installed in a Cisco access router, controller number 0, subslot 2, port number 0); the example enters controller configuration mode:

```
Router(config)# controller shdsl 0/2/0
Router(config-controller)#
```

Related Commands

Command	Description
show controller shdsl	Displays the controller status and statistics.

cos (CFM)

To set the class of service (CoS) for a maintenance endpoint (MEP) that will be sent in Ethernet connectivity fault management (CFM) messages, use the **cos** command in the Ethernet CFM interface configuration mode. To set the CoS to the highest priority allowed on the interface, use the **no** form of this command.

cos *cos-value*

no cos

Syntax Description

cos-value	Integer from 0 to 7 that identifies the CoS. The default is 0.

Command Default

If this command is not configured, the default CoS value is used.

Command Modes

Ethernet CFM interface configuration (config-if-ecfm-mep)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

This command is used to set the priority of messages.

CoS may not be supported on all platforms.

Examples

The following example shows how to set the CoS to 5:

```
Router(config)# ethernet cfm domain test level 5
Router(config-ecfm)# service vlan-id 17 vlan 17
Router(config-ecfm-srv)# exit
Router(config-ecfm)# exit
Router(config)# interface gigabitethernet 0/2
Router(config-if)# ethernet cfm mep domain test mpid 5 vlan 17
Router(config-if-ecfm-mep)# cos 5
Router(config-if-ecfm-mep)#
```

dejitter-buffer

To configure the size of the dejitter buffer, use the **dejitter-buffer** command in CEM configuration mode. To restore the dejitter buffer to its default size, use the **no** form of this command.

dejitter-buffer *size*

no dejitter-buffer

Syntax Description

size	Specifies the size of the dejitter buffer in milliseconds. The range is 4 to 500 ms; the default is 4 ms.

Defaults

The default dejitter-buffer size is 4 milliseconds.

Command Modes

CEM configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Examples

The following example shows how to specify the size of the dejitter buffer:

```
Router# config t
Router(config)# interface cem 0/0
Router(config-if)# no ip address
Router(config-if)# cem 0
Router(config-if-cem)# dejitter-buffer 10
Router(config-if-cem)# xconnect 10.10.10.10 200 encapsulation mpls
Router(config-if-cem-xconn)# exit
Router(config-if-cem)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
cem	Enters circuit emulation configuration mode.
cem class	Applies the CEM interface parameters defined in the given CEM class name to the circuit.
class cem	Configures CEM interface parameters in a class that's applied to CEM interfaces together in global configuration mode.

disable (CFM-AIS-link)

To disable the generation of Alarm Indication Signal (AIS) frames resulting from a link-status change (server maintenance endpoint [SMEP]), use the **disable** command in CFM SMEP AIS configuration mode (config-ais-link-cfm). To enable AIS frame generation, use the **no** form of this command.

disable

no disable

Syntax Description

This command has no arguments or keywords.

Command Default

AIS frames are generated.

Command Modes

CFM SMEP AIS configuration mode (config-ais-link-cfm)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
15.0(1)XA	This command was integrated into Cisco IOS Release 15.0(1)XA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

When the default value is configured, “no disable” is displayed when the **show running all** command is issued.

Examples

The following example shows how to disable AIS frame generation after a link-status change:

```
Router(config)# ethernet cfm ais link-status global
Router(config-ais-link-cfm)# disable
```

Related Commands

Command	Description
show running all	Displays the running configuration with default values.

dot1q tunneling ethertype

To define the Ethertype field type used by peer devices when implementing Q-in-Q VLAN tagging, use the **dot1q tunneling ethertype** command in interface configuration mode. To remove the VLAN tag Ethertype, use the **no** form of this command.

dot1q tunneling ethertype *ethertype*

no dot1q tunneling ethertype *ethertype*

Syntax Description

ethertype	Type of Ethertype field. Valid values are 0x8100, 0x9100, or 0x9200. Default is 0x8100.

Command Default

The Ethertype field used by peer devices when implementing Q-in-Q VLAN tagging is 0x8100.

Command Modes

Interface configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.3(7)XI1	This command was implemented on the Cisco 10000 series routers and additionally supports the 0x9200 Ethertype field value for the Cisco 10000 series routers.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
Cisco IOS XE Release 2.2	This command was integrated into Cisco IOS XE Release 2.2.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Use the **dot1q tunneling ethertype** command if the peer switching devices are using an Ethertype field value of 0x9100 or 0x9200. All Cisco switching devices use the default Ethertype field value of 0x8100. The Cisco 10000 series router additionally supports the 0x9200 Ethertype field value.

This command is used with the IEEE 802.1Q-in-Q VLAN Tag Termination feature in which double VLAN tagging is configured using the **encapsulation dot1q** command. 802.1Q double tagging allows a service provider to use a single VLAN to support customers who have multiple VLANs.

Examples

The following example shows how to configure an Ethertype field as 0x9100:

```
Router(config)# interface gigabitethernet 1/0/0
Router(config-if)# dot1q tunneling ethertype 0x9100
```

Related Commands

Command	Description
encapsulation dot1q	Enables 802.1Q encapsulation of traffic on a specified subinterface or range of subinterfaces.
interface	Configures an interface and enters interface configuration mode.

encapsulation (ATM)

To configure the ATM adaptation layer (AAL) and encapsulation type for an ATM virtual circuit (VC), VC class, VC, bundle, or permanent virtual circuit (PVC) range, use the **encapsulation** command in the appropriate mode. To remove an encapsulation type, use the **no** form of this command.

encapsulation {**aal5snap**} [**group** *group-name*]

no encapsulation {**aal5snap**} [**group** *group-name*]

Syntax Description

aal5snap	AAL and encapsulation type that supports Inverse Address Resolution Protocol (ARP). Logical link control/Subnetwork Access Protocol (LLC/SNAP) precedes the protocol datagram.
group	(Optional) Specifies that a PPPoE profile will be used by PPPoE sessions on the interface.
group-name	(Optional) Name of the PPPoE profile to be used by PPPoE sessions on the interface.

Command Default

The global default encapsulation option is **aal5snap**.

Command Modes

ATM VC configuration (for an ATM PVC or SVC)
Bundle configuration (for a VC bundle)
PVC range configuration (for an ATM PVC range)
PVC-in-range configuration (for an individual PVC within a PVC range)
VC-class configuration (for a VC class)

Command History

Release	Modification
11.3T	This command was introduced.
12.0(3)T	This command was enhanced to provide encapsulation configuration for ATM VC bundles. The **aal5mux frame** and **aal5mux voice** keywords were added for the Cisco MC3810 series router.
12.0(7)XK	Support for the **aal5mux voice** option was added to Cisco 3600 series routers.
12.0(7)T	The **aal5mux fr-atm-srv** option was added for the Cisco MC3810 router. The **aal5mux frame** option was changed to **aal5mux frame-relay**.
12.1(1)XA	Support for the **aal2** option was added to the Cisco MC3810 router.
12.1(3)T	The **aal5auto** option was added to provide encapsulation configuration for PPP over ATM SVCs.
12.1(5)XM	Support for the **aal2** option was added to the Cisco AS5300 access server and Cisco 3600 multiservice platforms.
12.1(5)T	The **aal5ciscoppp**, **aal5mux**, and **aal5snap** options were made available in PVC range and PVC-in-range configuration modes.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.

Release	Modification
12.1(1)DC1	The **aal5autoppp** option was introduced on the Cisco 6400 universal access concentrator.
12.2(4)T	The **aal5autoppp** option was integrated into Cisco IOS Release 12.2(4)T.
12.2(13)T	The **apollo**, **vines**, and **xns** values were removed as options for the *protocol* argument because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer supported in the Cisco IOS software.
12.2(15)T	The **group** option was added.
12.3(7)XI3	This command was integrated into Cisco IOS Release 12.3(7)XI3.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(11)XW	The **pppoe** and **bridge ieee8023** options were added.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

Release 12.4(20)MR only supports aal5snap encapsulation.

Examples

SNAP Encapsulation Example

The following example configures a bundle called “bundle1” for **aal5snap** encapsulation:

```
Router# configure terminal
Router(config)# int atm2/0
Router(config-if)# bundle bundle1
Router(config-if-atm-bundle)# encapsulation aal5snap
```

encapsulation udp (pw-class)

To configure a pseudowire-class to use UDP encapsulation instead of TCP. To restore the configuration and TCP encapsulation, use the **no** form of this command.

encapsulation udp

no encapsulation udp

Syntax Description

This command has no arguments or keywords.

Command Default

This command is disabled by default; TCP is the default encapsulation.

Command Modes

Pseudowire-class configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

When enabling UDP encapsulation, you must apply the **ip local interface** command to the pseudowire class in order to define the local IP address.

Examples

The following partial configuration enables UDP encapsulation on a CESoPSN pseudowire.

```
interface Loopback0
ip address 2.2.2.8 255.255.255.255
!
pseudowire-class udpClass
encapsulation udp
protocol none
ip local interface Loopback 0
!
controller E1 0/13
clock source internal
cem-group 0 timeslots 1-31
!
interface cem 0/13
cem 0
xconnect 2.2.2.9 200 pw-class udpClass
udp port local 50000 remote 60000
```

errdisable recovery

To configure recovery mechanism variables, use the **errdisable recovery** command in global configuration mode. To return to the default state, use the **no** form of this command.

errdisable recovery {**cause** {**all** | **arp-inspection** | **bpduguard** | **channel-misconfig** | **dhcp-rate-limit** | **dtp-flap** | **gbic-invalid** | **l2ptguard** | **link-flap** | **pagp-flap** | **psecure-violation** | **security-violation** | **storm-control** | **rootguard** | **udld** | **unicast-flood**} | **interval** seconds}

no errdisable recovery {**cause** {**all** | **arp-inspection** | **bpduguard** | **channel-misconfig** | **dhcp-rate-limit** | **dtp-flap** | **gbic-invalid** | **l2ptguard** | **link-flap** | **pagp-flap** | **psecure-violation** | **security-violation** | **storm-control** | **rootguard** | **udld** | **unicast-flood**} | **interval** seconds}

Syntax Description

cause	Enables error-disable recovery from a specific cause.
all	Enables the recovery timers for all error-disable causes.
arp-inspection	Enables error-disable recovery from an Address Resolution Protocol (ARP) inspection cause.
bpduguard	Enables the recovery timer for the Bridge Protocol Data Unit (BPDU)-guard error-disable cause.
channel-misconfig	Enables the recovery timer for the channel-misconfig error-disable cause.
dhcp-rate-limit	Enables the recovery timer for the Dynamic Host Configuration Protocol (DHCP)-rate-limit error-disable cause.
dtp-flap	Enables the recovery timer for the Dynamic Trunking Protocol (DTP)-flap error-disable cause.
gbic-invalid	Enables the recovery timer for the Gigabit Interface Converter (GBIC)-invalid error-disable cause.
l2ptguard	Enables the recovery timer for the Layer 2 Protocol Tunneling (L2PT) error-disable cause.
link-flap	Enables the recovery timer for the link-flap error-disable cause.
pagp-flap	Enables the recovery timer for the Port Aggregation Protocol (PAgP)-flap error-disable cause.
psecure-violation	Enables the recovery timer for the psecure-violation error-disable cause.
security-violation	Enables the automatic recovery of ports that were disabled because of 802.1X security violations.
storm-control	Enables the recovery timer for the storm-control cause.
rootguard	Enables the recovery timer for the root-guard error-disable cause.
udld	Enables the recovery timer for the Unidirectional Link Detection (UDLD) error-disable cause.
unicast-flood	Enables the recovery timer for the unicast-flood error-disable cause.
interval *seconds*	Specifies the time, in seconds, to recover from a specified error-disable cause. The range is from 30 to 86400. The default interval is 300.

Defaults

The recovery mechanisms are disabled.

Command Modes Global configuration (config)

Command History

Release	Modification
11.3	This command was introduced.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR and the **storm-control** keyword option was added.

Usage Guidelines A cause (bpduguard, channel-misconfig, dhcp-rate-limit, dtp-flap, l2ptguard, link-flap, pagp-flap, psecure-violation, security-violation, rootguard, udld, or unicast-flood) is defined as the reason why the error-disable state occurred. When a cause is detected on an interface, the interface is placed in an error-disable state (an operational state that is similar to the link-down state). If you do not enable error-disable recovery for the cause, the interface stays in the error-disable state until a shutdown and no shutdown occur. If you enable recovery for a cause, the interface is brought out of the error-disable state and allowed to retry operation once all the causes have timed out.

You must enter the **shutdown** command and then the **no shutdown** command to manually recover an interface from the error-disable state.

Note A separate line is required each time you want to enter the **errdisable recovery cause** command to add a new reason for recovery; each new reason does not get appended to the original single line. This means you must enter each new reason separately.

Examples This example shows how to enable the recovery timer for the storm-control error-disable cause:

```
Router(config)#
 errdisable recovery cause storm-control
```

This example shows how to set the recovery timer to 300 seconds:

```
Router(config)#
 errdisable recovery interval 300
```

Related Commands

Command	Description
show errdisable recovery	Displays the information about the error-disable recovery timer.
show interfaces status	Displays the interface status or a list of interfaces in an error-disabled state on LAN ports only.
shutdown	Disables an interface.

esmc mode

To enable ESMC messages on an interface, use the **esmc mode** command in interface configuration mode. To disable ESMC messages, use the **no** form of this command.

esmc mode {tx | rx}

no esmc mode {tx | rx}

Syntax Description

tx	Enables the ESMC message on transmitted traffic.
rx	Enables the ESMC message on received traffic.

Command Default

For synchronous Ethernet interfaces, ESMC is enabled by default. For asynchronous interfaces, ESMC is disabled by default.

This command is disabled by default; TCP is the default encapsulation.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

To use this command, you must first set the interface in synchronous mode.

Examples

The following example enables ESMC on an interface.

```
Router# configure terminal
Router(config)# interface gigabitethernet0/2
Router(config-if)# synchronous mode
Router(config-if)# esmc mode tx
Router(config-if)#
```

Related Commands

Command	Description
synchronous mode	Sets an interface in synchronous mode.

esmc mode ql-disabled

To disable quality level mode on a synchronous Ethernet interface, use the **esmc mode ql-disabled** command in interface configuration mode. To enable quality level mode, use the **no** form of this command.

esmc mode ql-disabled

no esmc mode ql-disabled

Syntax Description

This command has no arguments or keywords.

Command Default

For synchronous Ethernet interfaces, quality level clock selection is enabled by default. For asynchronous interfaces, quality level clock selection is disabled by default.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command only applies to synchronous Ethernet interfaces.

Examples

The following example disables quality level clock selection on a synchronous Ethernet interface.

```
Router# configure terminal
Router(config)# interface gigabitethernet 0/1
Router(config-if)# esmc mode ql-disabled
Router(config-if)
```

Related Commands

Command	Description
synchronous mode	Sets an interface in synchronous mode.

esmc process

To enable the router to send and receive ESMC messages on synchronous Ethernet interfaces, use the **esmc process** command in global configuration mode. To disable ESMC messages, use the **no** form of this command.

esmc process

no esmc process

Syntax Description

This command has no arguments or keywords.

Command Default

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command enables ESMC globally.

Examples

The following example shows how to enable ESMC messages on the router:

```
Router# configure terminal
Router(config)# esmc process
Router(config)# exit
Router#
```

Related Commands

Command	Description
synchronous mode	Sets an interface in synchronous mode.

ethernet cfm ais link-status

To enable Alarm Indication Signal (AIS) generation from a server maintenance endpoint (SMEP), use the **ethernet cfm ais link-status** command in interface configuration mode. To disable AIS generation, use the **no** form of this command.

ethernet cfm ais link-status [**level** *level-id* | **period** *seconds*]

no ethernet cfm ais link-status [**level** | **period**]

Syntax Description

level	(Optional) Indicates a maintenance domain level where the AIS will be sent.
level-id	(Optional) Integer from 0 to 7 that identifies the maintenance level.
period	(Optional) Configures the AIS transmission period generated by the SMEP on the interface.
seconds	(Optional) Integer value 1 or 60 that indicates the AIS transmission period in seconds. The default is 60.

Command Default

AIS frames are not generated.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
15.0(1)XA	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command has precedence over the **ethernet cfm ais link-status global** command issued in global configuration mode.

Examples

The following example shows how to configure AIS generation with a transmission period of 60 seconds:

```
Router# configure terminal
Router(config)# interface gigabitethernet 0/2
Router(config-if)# ethernet cfm ais link-status period 60
```

Related Commands

Command	Description
ethernet cfm ais link-status global	Globally enables AIS generation and places the CLI in CFM SMEP AIS configuration mode.

ethernet cfm ais link-status global

To globally enable Alarm Indication Signal (AIS) generation and place the command-line interface (CLI) in CFM SMEP AIS configuration mode (config-ais-link-cfm) to configure AIS commands for a server maintenance endpoint (SMEP), use the **ethernet cfm ais link-status global** command in global configuration mode. To remove the global AIS configuration, use the **no** form of this command.

ethernet cfm ais link-status global

no ethernet cfm ais link-status global

Syntax Description

This command has no arguments or keywords.

Command Default

AIS generation is enabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
15.0(1)XA	This command was integrated into Cisco IOS Release 15.0(1)XA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **ethernet cfm ais link-status global** command changes configuration modes to allow you to configure AIS commands for a SMEP.

Examples

The following example shows how to configure AIS commands for a SMEP:

```
Router(config)# ethernet cfm ais link-status global
Router(config-ais-link-cfm)#
```

Related Commands

Command	Description
ethernet cfm ais link-status	Enables Alarm Indication Signal (AIS) generation from a server maintenance endpoint (SMEP).

ethernet cfm alarm

To configure an alarm for Ethernet connectivity fault management (CFM), use the **ethernet cfm alarm** command in global configuration mode. To restore the command options' default values, use the **no** form of this command.

ethernet cfm alarm {**delay** *mseconds* | **notification** {**all** | **error-xcon** | **mac-remote-error-xcon** | **none** | **remote-error-xcon** | **xcon**} | **reset** *mseconds*}

no ethernet cfm alarm {**delay** | **notification** {**all** | **error-xcon** | **mac-remote-error-xcon** | **none** | **remote-error-xcon** | **xcon**} | **reset**}

Syntax Description

delay	Sets a delay time value during which one or more defects must be present before a fault alarm is issued.
mseconds	Integer from 2500 to 10000 that specifies the number of milliseconds for either a delay or a reset of an alarm. • The default is 2500 for the **delay** option. The default is 10000 for the **reset** option.
notification	Sets the defects that are to be reported if fault alarms are enabled. This configuration is global and can be overridden by the fault alarm configurations on a supported interface.
all	Reports all defects: DefRDI, DefMACStatus, DefRemote, DefError, and DefXcon.
error-xcon	Reports only DefError and DefXcon defects.
mac-remote-error-xcon	Reports only DefMACStatus, DefRemote, DefError, and DefXcon (default) defects. This option is the default.
none	No defects are reported.
remote-error-xcon	Reports only DefRemote, DefError, and DefXcon defects.
xcon	Reports only DefXcon defects.
reset	Sets a reset time value that, after a fault alarm, no defects must be present before another fault alarm is enabled.

Command Default

Ethernet CFM alarms are disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If a higher priority defect occurs after a lower priority defect has triggered an alarm but before the alarm has reset, immediately issue another fault alarm for the higher priority defect.

Output of the **show running all** command displays “ethernet cfm alarm delay 2500” when the default value for the delay option is configured and “ethernet cfm alarm reset 10000” when the default value for the reset option is configured.

Examples

The following example shows how to set up notification for all defects:

```
Router(config)# ethernet cfm alarm notification all
```

The following example shows how to set the time during which one or more defects must be present before a fault alarm is issued to 5000 milliseconds:

```
Router(config)# ethernet cfm alarm delay 5000
```

Related Commands

Command	Description
show running all	Shows the running configuration with default values.

ethernet cfm cc enable level vlan

Use the **ethernet cfm cc enable level vlan** command in global configuration mode to globally enable transmission of continuity check messages (CCMs). To disable transmission of CCMs, use the **no** form of this command.

Note This command has been replaced with the **continuity-check** command in Cisco IOS Release 15.0(1)MR.

ethernet cfm cc enable level {**any** | *level-id* | **,***level-id* | *level-id***-***level-id* | **,***level-id***-***level-id*}
vlan {**any** | *vlan-id* | **,***vlan-id* | *vlan-id***-***vlan-id* | **,***vlan-id***-***vlan-id*}

no ethernet cfm cc enable level {**any** | *level-id* | **,***level-id* | *level-id***-***level-id* | **,***level-id***-***level-id*}
vlan {**any** | *vlan-id* | **,***vlan-id* | *vlan-id***-***vlan-id* | **,***vlan-id***-***vlan-id*}

Syntax Description

any	Enables CCMs for all levels.
level-id	Integer from 0 to 7 that identifies a maintenance level.
,*level-id*	Integers from 0 to 7, separated by commas, that list levels to be enabled.
*level-id***-***level-id*	Integers from 0 to 7 that define a range of levels to be enabled. The hyphen is required to separate starting and ending values that define the range.
,*level-id***-***level-id*	Integers from 0 to 7 that define a list of ranges to be enabled. The comma must be entered to separate ranges. The hyphen is required to separate starting and ending values that are used to define each range of levels to be enabled.
any	Indicates all VLANs are to be configured.
vlan-id	Integer from 1 to 4094 that identifies a VLAN to be configured.
,*vlan-id*	Integers from 1 to 4094, separated by commas, that list VLANs to be configured.
*vlan-id***-***vlan-id*	Integers from 1 to 4094 that define a range of VLANs to be configured. The hyphen is required to separate starting and ending values that are used to define the range.
,*vlan-id***-***vlan-id*	Integers from 1 to 4094 that define a list of VLAN ranges to be configured. The comma must be entered to separate ranges. The hyphen is required to separate starting and ending values that are used to define each range of VLANs.

Command Default

No CCMs are transmitted.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.

Release	Modification
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was replaced with the **continuity-check** command.

Usage Guidelines

Use the **ethernet cfm cc enable level vlan** command to enable transmission of CCMs in one of the following ways:

- Globally (per device)
- For a particular level
- For a particular VLAN
- For a combination of level and VLAN

How you enter the **ethernet cfm cc enable level vlan** command and the format you see in the configuration may be different. For example, if you enter:

```
Router(config)# ethernet cfm cc enable level 1,2,3,4,5 vlan 100,101,102,103,105
```

The configuration shows the following:

```
ethernet cfm cc enable level 1-5 vlan 100-103,105
```

To shorten the length of the command, you also can enter it this way.

Examples

The following examples show how this command functions:

1. The command already configured is:

   ```
   ethernet cfm cc enable level 1-5 vlan 100-200
   ```

2. You configure this new command:

   ```
   Router(config)# no ethernet cfm cc enable level 2-3 vlan 50-150
   ```

3. The following commands are generated as a result of the command you have just configured. Note that these commands are different from the command you entered.

   ```
   ethernet cfm cc enable level 1,4-5 vlan 100-200
   ethernet cfm cc enable level 2-3 vlan 151-200
   ```

ethernet cfm domain level

To define a connectivity fault management (CFM) maintenance domain at a particular maintenance level and put the command-line interface (CLI) into Ethernet CFM configuration mode, use the **ethernet cfm domain level** command in global configuration mode. To remove the CFM domain at the specified level, use the **no** form of this command.

Note This command has been replaced with the **ethernet cfm global** command in Cisco IOS Release 15.0(1)MR.

ethernet cfm domain *domain-name* **level** *level-id*

no ethernet cfm domain *domain-name* **level** *level-id*

Syntax Description

domain-name	String of a maximum of 154 characters that identifies the domain.
level-id	Integer from 0 to 7 that identifies the maintenance level.

Command Default

No maintenance domains are assigned to maintenance levels if this command is not issued.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T. The **direction outward** keywords were added.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was replaced with the **ethernet cfm global** command in Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When a router is in Ethernet CFM configuration mode, parameters specific to a maintenance domain can be set. Several domains, with different names, can be configured at the same maintenance level; however, a single domain cannot be associated with multiple levels.

In CFM IEEE, if a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if “id <fmt> <MDID>” is not configured.

When this command places the CLI in Ethernet configuration mode, in CFM D1 the mode prompt is “config-ether-cfm” and in CFM IEEE the mode prompt is “config-ecfm.”

Examples

The following example shows how to define a domain named cust10 at level 5 and also shows the Ethernet CFM configuration mode prompt that is displayed in the CFM IEEE Standard implementation:

```
Router(config)# ethernet cfm domain cust10 level 5
Router(config-ether-cfm)#
```

Related Commands

Command	Description
show ethernet cfm domain	Displays information about maintenance points configured on a device.
show ethernet cfm maintenance-points local	Displays information about maintenance points configured on a device.

ethernet cfm enable

To enable connectivity fault management (CFM) processing globally on a device, use the **ethernet cfm enable** command in global configuration mode. To disable CFM processing globally on a device, use the **no** form of this command.

Note This command has been replaced by the **ethernet cfm global** command in Release 15.0(1)MR.

ethernet cfm enable

no ethernet cfm enable

Syntax Description

This command has no arguments or keywords.

Command Default

Ethernet CFM is disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was replaced by the **ethernet cfm global** command in Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Ethernet CFM is disabled by default and must be enabled explicitly. When CFM is configured, hardware resources (for example, port-ASIC match-registers) are allocated for CFM.

Examples

The following example shows how to enable CFM processing globally on a device:

```
Router(config)# ethernet cfm enable
```

Related Commands

Command	Description
ethernet cfm enable (interface)	Enables connectivity fault management (CFM) processing on an interface.

ethernet cfm enable (interface)

To enable connectivity fault management (CFM) processing on an interface, use the **ethernet cfm enable** command in interface configuration mode. To disable CFM processing on an interface, use the **no** form of this command.

Note This command was replaced by the **ethernet cfm global** command in Release 15.0(1)MR.

ethernet cfm enable

no ethernet cfm enable

Syntax Description

This command has no arguments or keywords.

Command Default

Ethernet CFM is enabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was replaced by the **ethernet cfm global** command in Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Ethernet CFM is enabled by default on an interface and must be disabled explicitly. When CFM is disabled on an interface, hardware resources (for example, port-ASIC match-registers) are released for that interface.

This command is mutually exclusive of maintenance intermediate point (MIP) and maintenance end point (MEP) configuration commands. The interface must be enabled before any MEPs or MIPs can be configured. Similarly, disabling a port that has MIPs or MEPs configured is not allowed. The user must first unconfigure the maintenance points.

When CFM processing is disabled on an interface, all CFM frames that arrive at that interface are forwarded as normal data traffic, and are not processed by the CPU.

Examples

The following example shows how to disable and then enable CFM processing on an interface:

```
Router(config-if)# no ethernet cfm enable
Router(config-if)# ethernet cfm enable
```

Related Commands

Command	Description
ethernet cfm enable	Enables connectivity fault management (CFM) processing globally on a device.

ethernet cfm global

To enable Ethernet connectivity fault management (CFM) globally on a device, use the **ethernet cfm global** command in global configuration mode. To disable CFM globally on a device, use the **no** form of this command.

ethernet cfm global

no ethernet cfm global

Syntax Description

This command has no arguments or keywords.

Command Default

Ethernet CFM is disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Ethernet CFM is disabled by default and must be enabled explicitly. When CFM is configured, hardware resources (for example, port-ASIC match registers) are allocated for CFM.

This command is supported only in the Ethernet CFM IEEE 802.1ag Standard implementation.

Examples

The following example shows how to enable CFM globally on a device:

```
Router(config)# ethernet cfm global
```

Related Commands

Command	Description
ethernet cfm ieee	Enables the Ethernet Connectivity Fault Management 802.1ag Standard (CFM IEEE) version of CFM.

ethernet cfm ieee

To enable the Ethernet Connectivity Fault Management 802.1ag Standard (CFM IEEE) version of CFM, use the **ethernet cfm ieee** command in global configuration mode. To disable the CFM IEEE version, use the **no** form of this command.

ethernet cfm ieee

no ethernet cfm ieee

Syntax Description

This command has no arguments or keywords.

Command Default

Ethernet CFM IEEE is disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is auto-generated when CFM is enabled and running IEEE CFM. In Cisco pre-Standard CFM Draft 1 (CFM D1), this command is not supported.

Examples

The following example shows how to enable Ethernet CFM IEEE:

```
Router(config)# ethernet cfm ieee
```

Related Commands

Command	Description
ethernet cfm global	Enables connectivity fault management (CFM) processing globally on a device.

ethernet cfm interface

To enable Ethernet connectivity fault management (CFM) processing on a port, use the **ethernet cfm interface** command in interface configuration mode. To disable Ethernet CFM processing, use the **no** form of this command.

ethernet cfm interface

no ethernet cfm interface

Syntax Description

This command has no arguments or keywords.

Command Default

CFM processing is enabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is mutually exclusive of the maintenance intermediate point (MIP) and maintenance endpoint (MEP) configuration commands. A port must be enabled before any MEPs or MIPs can be configured. Similarly, maintenance points must be unconfigured before a port configured with MIPs or MEPs can be disabled.

When CFM processing is disabled on a port, all CFM frames that arrive at that port are dropped and are not processed by the CPU.

CFM is enabled by default on a port and must be disabled explicitly. When CFM is disabled on a port, hardware resources such as port-ASIC match registers are released for that port.

Examples

The following example shows how to configure an Ethernet interface for CFM processing:

```
Router(config-if)# ethernet cfm interface
Router(config-if)#
```

Related Commands

Command	Description
ethernet cfm enable (interface)	Enables connectivity fault management (CFM) processing on an interface.

ethernet cfm logging

To enable Ethernet Connectivity Fault Management (CFM) syslog messages, use the **ethernet cfm logging** command in global configuration mode. To disable CFM syslog messages, use the **no** form of this command.

CFM IEEE 802.1ag Standard (CFM IEEE)

ethernet cfm logging [**ais** | **alarm** {**cisco** | **ieee**} | **lck**]

no ethernet cfm logging [**ais** | **alarm** {**cisco** | **ieee**} | **lck**]

Syntax Description

ais	(Optional) Enables syslog messages specific to the CFM Alarm Indication Signal (AIS) feature.
alarm	(Optional) Specifies an alarm.
cisco	(Optional) Enables alarm syslog messages for Cisco MIBs.
ieee	(Optional) Enables alarm syslog messages for IEEE MIBs for all VLAN services.
lck	(Optional) Enables syslog messages specific to the CFM Locked Signal function (LCK).

Command Default

CFM logging is not enabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the Cisco pre-standard CFM Draft 1 (CFM D1).

Examples

The following example shows how to enable all Ethernet CFM syslog messages:

```
Router(config)# ethernet cfm logging
```

The following example shows how to enable all alarm syslog messages for Cisco MIBs:

```
Router(config)# ethernet cfm logging alarm cisco
```

The following example shows how to enable syslog messages specific to the CFM AIS feature:

```
Router(config)# ethernet cfm logging ais
```

Related Commands

Command	Description
ethernet cfm enable	Enables connectivity fault management (CFM) processing globally on a device.

ethernet cfm mep crosscheck

To enable cross-checking between the list of configured remote maintenance endpoints (MEPs) of a domain and MEPs learned through continuity check messages (CCMs), use the **ethernet cfm mep crosscheck** command in privileged EXEC mode. To disable cross-checking, use the **ethernet cfm mep crosscheck disable** command.

CFM IEEE 802.1ag Standard (CFM IEEE)

ethernet cfm mep crosscheck {**enable** | **disable**} **domain** *domain-name* {**port** | **vlan**{*vlan-id* | *vlan-id*-*vlan-id* | **,***vlan-id*-*vlan-id*}}

Syntax Description

enable	Indicates that cross-checking will occur.
disable	Indicates that cross-checking will not occur.
vlan	Indicates a VLAN for cross-checking.
vlan-id	Integer from 1 to 4094 that identifies the VLAN.
any	Indicates all VLANs are to be configured. • This option is supported only in CFM D1.
vlan-id-*vlan-id*	Integer values from 1 to 4094. The hyphen is required to separate starting and ending VLAN ID values that are used to define a range of IDs.
,*vlan-id*-*vlan-id*	(Optional) Integer values from 1 to 4094. The comma must be entered to separate VLAN ID ranges. The hyphen is required to separate starting and ending VLAN ID values that are used to define each range of IDs.
domain	Specifies a maintenance domain.
domain-name	String of a maximum of 154 characters that identifies the maintenance domain.
port	Specifies a DOWN service direction with no VLAN associations (untagged).

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SRD	The **evc** keyword and *evc-name* argument were added on the Cisco 7600 Series Route Switch Processor 720 (RSP 720) and the Cisco 7600 Series Supervisor Engine 720.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the **evc** parameter.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **level** keyword used to configure CFM Draft 1.0.

Usage Guidelines

Before you issue this command, you must configure a static list of MEPs using the **mep crosscheck mpid vlan** command. To enable cross-checking after a device has booted up, you must issue the **ethernet cfm mep crosscheck enable** command.

A **no** form of this command does not exist. Cross-checking is disabled when you issue the command with the **disable** keyword.

In CFM IEEE, if a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

To view the results of a cross-check operation, use the **show ethernet cfm maintenance-points remote crosscheck** command. To view errors in the cross-check operation, use the **show ethernet cfm errors** command. Both commands are used in privileged EXEC mode.

Traps are generated after a cross-check operation is completed if cross-check traps are already enabled and, if as the result of the cross-check operation, a condition warrants a trap to be sent.

An EVC is an association of two or more user network interfaces (UNIs). EVCs are not supported in Cisco IOS Release 12.2(33)SXI2.

Examples

The following example shows how to enable an Ethernet CFM MEP cross-check on a port MEP in CFM IEEE:

```
Router# ethernet cfm mep crosscheck enable domain customerA port
```

The following example shows how to enable an Ethernet CFM MEP cross-check in CFM D1 at level 2 for VLAN IDs in the range of 3000 to 3375:

```
Router# ethernet cfm mep crosscheck enable level 2 vlan 3000-3375
```

Related Commands

Command	Description
mep crosscheck mpid vlan	Statically defines a remote MEP within a maintenance domain.
show ethernet cfm errors	Displays CFM continuity check error conditions logged on a device since it was last reset or since the log was last cleared.
show ethernet cfm maintenance-points remote crosscheck	Displays detailed information about remote MEPs in the cross-check list that were statically configured.

ethernet cfm mep crosscheck start-delay

To configure the maximum amount of time that a device waits for remote maintenance endpoints (MEPs) to come up before the cross-check operation is started, use the **ethernet cfm mep crosscheck start-delay** command in global configuration mode. To restore the default number of seconds a device waits, use the **no** form of this command.

ethernet cfm mep crosscheck start-delay *delay*

no ethernet cfm mep crosscheck start-delay *delay*

Syntax Description

delay	Integer from 1 to 65535 that specifies the number of seconds a device waits for remote MEPs to come up before the cross-check is started. The default is 30.

Command Default

The start delay interval is enabled with a default of 30 seconds.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If continuity check intervals in your network are greater than 30 seconds (the delay default), you must configure the start-delay to match the greatest interval to avoid unnecessary traps.

When the default value is configured, “ethernet cfm mep crosscheck start-delay 30” is displayed when the **show running all** command is issued.'

Examples

The following example shows how to set the maximum number of seconds that a device will wait for remote MEPs to come up before the cross-check operation is started to 700:

```
Router(config)# ethernet cfm mep crosscheck start-delay 700
```

Related Commands

Command	Description
show running all	Shows the running configuration with default values.

ethernet cfm mep domain mpid

To set a port as internal to a maintenance domain and define it as a maintenance endpoint (MEP), use the **ethernet cfm mep domain mpid** command in interface configuration mode. Also, use this command to place the command-line interface (CLI) in Ethernet connectivity fault management (CFM) MEP configuration mode (config-if-ecfm-mep). To restore the default configuration of the port, use the **no** form of this command.

ethernet cfm mep domain *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}

no ethernet cfm mep domain *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}

Syntax Description

domain-name	String of a maximum of 154 characters.
mpid	Integer from 1 to 8191 that identifies the MEP.
port	Configures the DOWN service direction with no VLAN association (untagged).
vlan	Configures a VLAN.
vlan-id	Integer from 1 to 4094 that identifies a VLAN.

Command Default

This command is disabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **level**, **inward**, and **outward** keywords used to configure CFM Draft 1.0.

Usage Guidelines

A single interface may belong to multiple domains, meaning that you can issue multiple instances of the **ethernet cfm mep domain mpid** command for different domains.

If a specified domain has not been configured, an error message is displayed and the command is rejected.

If an interface is manually provisioned to have a maintenance intermediate point (MIP) at a certain maintenance level and you attempt to configure it as a MEP for a VLAN on the same or a higher level, an error message is displayed and the command is rejected.

If the VLAN for which a MEP is configured is removed from an interface, the MEP configuration is also removed; the VLAN and the definition of the MEP are interrelated.

If a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

Examples

The following example shows how to set a port as internal to a maintenance domain, define it as a maintenance endpoint (MEP), and configure VLAN 17:

```
Router(config)# interface ethernet 0/1
Router(config-if)# ethernet cfm mep domain CustomerB mpid 5 vlan 17
Router(config-if)#
```

Related Commands

Command	Description
mep crosscheck mpid vlan	Statically defines a remote MEP within a maintenance domain.

ethernet cfm mip

To globally provision maintenance intermediate points (MIPs) at a specified maintenance level for VLAN IDs that are not associated with specific maintenance associations (MAs) and to enable level filtering, use the **ethernet cfm mip** command in global configuration mode. To remove a MIP, use the **no** form of this command.

ethernet cfm mip {**auto-create level** *level-id* **vlan** {*vlan-id* | *vlan-id-vlan-id* | ,*vlan-id-vlan-id*} [**lower-mep-only**] [**sender-id chassis**] | **filter**}

no ethernet cfm mip {**auto-create level** *level-id* **vlan** {*vlan-id* | *vlan-id-vlan-id* | ,*vlan-id-vlan-id*} [**lower-mep-only**] [**sender-id** {**chassis | manage | chassis-manage}**] | **filter**}

Syntax Description

auto-create	Dynamically creates a connectivity fault management (CFM) MIP.
level	Specifies a maintenance domain level.
level-id	Integer from 0 to 7 that identifies the maintenance level.
vlan	Indicates a VLAN for configuration.
vlan-id	Integer from 1 to 4094 that identifies the VLAN to be configured.
vlan-id-vlan-id	Integers from 1 to 4094 that define a range of VLANs to be configured. • The hyphen is required to separate the starting and ending VLAN ID values that are used to define the range of VLAN IDs.
,*vlan-id-vlan-id*	Integers from 1 to 4094 that define a range of VLANs to be configured. • The comma is required to separate VLAN ranges.
lower-mep-only	(Optional) Creates a MIP only if a MEP is configured at the next lower active maintenance domain level for the VLAN ID on the port.
sender-id	(Optional) Configures the Sender ID option to send for VLAN IDs that are not associated with specific maintenance associations. If the **sender-id** option is not configured, the Sender ID TLV is not included in messages.
chassis	(Optional) Sends the chassis ID.
filter	Configures a CFM MIP filter that drops all CFM frames at a lower level independent of whether they come from the wire or relay function side. • Level filtering is disabled by default.

Command Default

MIPs are not provisioned.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.

Release	Modification
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

MIPs will be provisioned only if all the policies have been met.

This command has lower precedence than the manual MIP **ethernet cfm mip level** (interface configuration mode) configuration command. For example, if you manually configure a MIP for a particular MA, that configuration overrides the MIP created by the global **ethernet cfm mip** command for that MA.

Examples

The following example shows how to dynamically create a MIP at maintenance level 6 and configure VLAN 500 if a MEP is configured at the next lower active maintenance domain level for the VLAN ID on the port:

```
Router(config)# ethernet cfm mip auto-create level 6 vlan 500 lower-mep-only
```

Related Commands

Command	Description
cfm mip level	Sets a port as internal to a maintenance domain, and defines it as a MIP for a MA.
ethernet cfm mip level	Sets a port as internal to a maintenance domain, and defines it as a MIP.

ethernet cfm mip level

To provision a maintenance intermediate point (MIP) at a specified maintenance level on an interface, use the **ethernet cfm mip level** command in interface configuration mode. To restore the default configuration of the interface, use the **no** form of this command.

CFM IEEE 802.1ag Standard (CFM IEEE)

ethernet cfm mip level *level-id* [**vlan** {*vlan-id* | *vlan-id*-*vlan-id* | **,***vlan-id*-*vlan-id*}]

no ethernet cfm mip level *level-id* [**vlan** {*vlan-id* | *vlan-id*-*vlan-id* | **,***vlan-id*-*vlan-id*}]

Syntax Description

level-id	Integer from 0 to 7 that specifies the maintenance levels at which MIPs can be defined.
vlan	(Optional) Indicates a VLAN for configuration.
vlan-id	(Optional) Integer from 1 to 4094 that identifies the VLAN to be configured.
vlan-id-*vlan-id*	(Optional) Integers from 1 to 4094 that define a valid range of VLANs to be configured. • The hyphen is required to separate the starting and ending VLAN ID values that are used to define the range of VLAN IDs.
,*vlan-id-vlan-id*	(Optional) Integers from 1 to 4094 that define a valid range of VLANs to be configured. • The comma is required to separate VLAN ranges.

Command Default

No MIPs are configured.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the Cisco pre-Standard Connectivity Fault Management Draft 1 (CFM D1).

Usage Guidelines

If you do not configure a VLAN, this command creates MIPs for all VLANs on an interface.

In the CFM D1 implementation, you must first configure a domain using the **ethernet cfm domain** command at the level you want to configure the MIP; otherwise, the **ethernet cfm mip level** command is rejected. In the CFM IEEE implementation, preconfiguring a domain is not required.

You cannot configure a MIP at a level lower than the level of already configured maintenance endpoints (MEPs) on an interface.

Configuring a MIP using this command is known as a manual MIP and has precedence over the **mip auto-create** command.

Examples

The following example shows how to provision a MIP at maintenance level 5 and then issue the **show ethernet cfm maintenance-points local** command to display the list of configured MIPs in the device:

```
Router(config-if)# ethernet cfm mip level 5
Router(config-if)# Ctrl-Z
Router# show ethernet cfm maintenance-points local
```

Related Commands

Command	Description
ethernet cfm domain	Defines a CFM domain.
mip auto-create	Enables the automatic creation of a MIP at a maintenance domain level.
show ethernet cfm maintenance-points local	Displays information about maintenance points configured on a device.

ethernet cfm traceroute cache

To enable caching of Ethernet connectivity fault management (CFM) data learned through traceroute messages, use the **ethernet cfm traceroute cache** command in global configuration mode. To disable caching, use the **no** form of this command.

ethernet cfm traceroute cache

no ethernet cfm traceroute cache

Syntax Description

This command has no arguments or keywords.

Command Default

Caching is disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Setting a traceroute cache allows you to store the results of traceroute operations initiated on the device.

Examples

The following example shows how to enable Ethernet CFM traceroute cache:

```
Router(config)# ethernet cfm traceroute cache
```

Related Commands

ethernet cfm traceroute cache hold-time	Sets a maximum time that Ethernet CFM traceroute cache entries will be retained.
ethernet cfm traceroute cache size	Sets a maximum number for entries in an Ethernet CFM traceroute cache table.

ethernet cfm traceroute cache hold-time

To set the time that Ethernet connectivity fault management (CFM) traceroute cache entries are retained, use the **ethernet cfm traceroute cache hold-time** command in global configuration mode. To remove the configured time, use the **no** form of this command.

ethernet cfm traceroute cache hold-time *minutes*

no ethernet cfm traceroute cache hold-time

Syntax Description

minutes	Integer in the range of 1 to 65535 that specifies the number of minutes that cache entries will be retained. The default is 100.

Command Default

Entries are retained for 100 minutes.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Before you can issue this command, you must have enabled traceroute caching using the **ethernet cfm traceroute cache** command.

If traceroute cache is enabled and not empty and you change the hold time to less than the currently configured time, the change is rejected. You are prompted to clean up the table before the new hold time can be accepted. For example:

```
Router(config)# ethernet cfm traceroute cache hold-time 5
Please clean up the cache before setting smaller hold-time
current hold time = 100 Command Aborted.
Router(config)#
```

Output of the **show running all** command displays “ethernet cfm traceroute cache hold-time 100” when traceroute cache is enabled and the default value of 100 is configured.

Examples

The following example shows how to set the retention time for entries in an Ethernet CFM traceroute cache table to 5 minutes:

```
Router(config)# ethernet cfm traceroute cache hold-time 5
```

Related Commands

ethernet cfm traceroute cache	Enables caching of Ethernet CFM data learned from traceroute messages.
ethernet cfm traceroute cache size	Sets a maximum number for entries in an Ethernet CFM traceroute cache table.
show running all	Shows the running configuration with default values.

ethernet cfm traceroute cache size

To set a maximum size for the Ethernet connectivity fault management (CFM) traceroute cache table, use the **ethernet cfm traceroute cache size** command in global configuration mode. To remove the configured size, use the **no** form of this command.

ethernet cfm traceroute cache size *entries*

no ethernet cfm traceroute cache size

Syntax Description

entries	Number of entries in the traceroute cache table, expressed as an integer in the range of 1 to 4095. The default is 100.

Command Default

If traceroute cache is enabled, traceroute replies are cached up to a maximum of 100 entries.

If traceroute cache is disabled, traceroute replies are not cached; the default size is 0.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Before you can issue this command, you must have enabled traceroute caching using the **ethernet cfm traceroute cache** command.

Entries in the traceroute cache table are single replies from remote devices—not the number of operations on the device. In Cisco pre-Standard CFM Draft 1 when the maximum cache size is reached, new replies cannot be added until you clear the cache or increase its size. In CFM IEEE 802.1ag Standard when the maximum cache size is reached, the oldest traceroute operation is removed to make room for a new traceroute operation.

Output of the **show running all** command displays “ethernet cfm traceroute cache size 100” when traceroute cache is enabled and the default value of 100 is configured.

Setting the number of entries lower than the number of entries currently cached causes this command to be rejected, and you are prompted to clear the traceroute cache.

Examples

The following example shows how to set the maximum number of entries in an Ethernet CFM traceroute cache table to 2500:

```
Router(config)# ethernet cfm traceroute cache size 2500
```

Related Commands

Command	Description
ethernet cfm traceroute cache	Enables caching of Ethernet CFM data learned from traceroute messages.
ethernet cfm traceroute cache hold-time	Sets the maximum time that Ethernet CFM traceroute cache entries will be retained.
show running all	Shows the running configuration with default values.

ethernet lmi

To set Ethernet local management interface (LMI) parameters for a user-network interface (UNI), use the **ethernet lmi** command in interface configuration mode. To remove Ethernet LMI parameters on a UNI, use the **no** form of this command.

ethernet lmi {**n391** | **n393** | **t391** | **t392**} *value*

no ethernet lmi {**n391** | **n393** | **t391** | **t392**}

Syntax Description

n391	Polling counter on the customer equipment. A polling counter polls the status of the UNI and all Ethernet virtual connections (EVCs).
n393	An error counter for customer equipment or for a metro Ethernet network.
t391	Polling timer on the customer equipment. A polling timer transmits status enquiries and when status messages are not received, records errors.
t392	Polling verification timer on the metro Ethernet network. The polling verification timer verifies status enquiries received. When a timer expires, an error is recorded and the timer is restarted. **Note** The t392 timer is valid only on Ethernet LMI provider edge (PE) devices. It is not available on customer edge (CE) devices.
value	Integer value within ranges that vary depending on the keyword with which it is used. Valid values are as follows: • **n391**—1 to 65000. Default is 360. • **n393**—1 to 10. Default is 4. • **t391**—5 to 30 (seconds). Default is 10. • **t392**—5 to 30 (seconds); default is 15 or 0 to 0 (0–0), which disables the timer.

Command Default

Ethernet LMI parameters are not set on any UNIs.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.4(9)T	This command was introduced.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The value for the polling verification timer (t392) should be greater than the value for the polling timer (t391).

The polling verification timer (t392) can be disabled.

A very high value for the polling timer (t391) means more time spent detecting Ethernet LMI link-down errors.

Examples

The following example shows how to set a polling counter for 30 seconds on interface Ethernet 1/0:

```
Router# configure terminal
Router(config)# interface ethernet 1/0
Router(config-if)# ethernet lmi t391 30
```

ethernet lmi global

To enable Ethernet local management interface (LMI) functionality globally on a device, use the **ethernet lmi global** command in global configuration mode. To disable Ethernet LMI globally on a device, use the **no** form of this command.

ethernet lmi global

no ethernet lmi global

Syntax Description

This command has no arguments or keywords.

Command Default

Ethernet LMI is disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.4(9)T	This command was introduced.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Ethernet LMI is disabled by default on an interface and must be explicitly enabled. The **ethernet lmi global** command enables Ethernet LMI on all interfaces for an entire device. The benefit of this command is that you can enable Ethernet LMI on all interfaces with one command compared to enabling Ethernet LMI separately on each interface.

To disable Ethernet LMI on a specific interface after the **ethernet lmi global** command has been issued, the **no ethernet lmi interface** command must be issued on that interface.

The sequence in which the **ethernet lmi interface** and **ethernet lmi global** commands are issued is significant. The latest command issued overrides the prior command issued.

Examples

The following example shows how to enable Ethernet LMI globally on a device:

```
Router(config)# ethernet lmi global
```

Related Commands

Command	Description
ethernet lmi interface	Enables Ethernet LMI for a user-network interface.

ethernet lmi interface

To enable Ethernet local management interface (LMI) on a user-network interface (UNI), use the **ethernet lmi interface** command in interface configuration mode. To remove Ethernet LMI on a UNI, use the **no** form of this command.

ethernet lmi interface

no ethernet lmi interface

Syntax Description

This command has no arguments or keywords.

Command Default

Ethernet LMI parameters are not set on any UNIs.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.4(9)T	This command was introduced.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command enables Ethernet LMI processing on an interface if the **ethernet lmi global** command has not been issued. When the **ethernet lmi global** command has been issued, Ethernet LMI is enabled on all interfaces. In this case, the **no ethernet lmi interface** command overrides the **ethernet lmi global** command and disables Ethernet LMI processing on the interface.

The sequence in which the commands are issued is significant. The latest command issued overrides the prior command issued.

Examples

The following example shows how to enable Ethernet LMI on interface Ethernet 1/0:

```
Router# configure terminal
Router(config)# interface ethernet 1/0
Router(config-if)# ethernet lmi interface
```

Related Commands

Command	Description
ethernet lmi global	Enables Ethernet LMI functionality globally on a device.

ethernet loopback (interface configuration)

Use the **ethernet loopback facility** interface configuration command to configure per-port loopbacks for testing connectivity across multiple devices. Use the **no** form of this command to remove the configuration.

ethernet loopback facility [**vlan** *vlan-id*] **swap** [**timeout** {*seconds* | **none**}]

no ethernet loopback

Syntax Description

facility	Configure a facility loopback for connectivity testing.
vlan *vlan-id*	Specifies the VLAN that handles loopback traffic. Valid values are 1–4094.
swap	Configures the port to swap the MAC source and destination addresses during loopback.
timeout *seconds*	Configure a loopback timeout period in seconds. The range is from 5 to 300 seconds. There is no default timeout value.
timeout none	Configure the loop back to not timeout.

Command Default

No loopbacks are configured. If no mac-address option is configured, the default is to copy the source and destination addresses.

Command Modes

Interface configuration

Command History

Release	Modification
15.1(1)MR	This command was introduced.

Usage Guidelines

You can configure Ethernet loopback on physical ports only, not on VLANs or port channels.

A facility loopback puts the port into a state where the link is up, but the line protocol is down for regular traffic. The device loops back all received traffic.

A port shutdown or a change from a switchport to a routed port ends the loopback.

You can configure one loopback per port, but a maximum of two loopbacks per device. .

Ethernet loopback interactions with other features:

- You cannot configure SPAN and loopback on a switch at the same time. If you try to configure SPAN on any port on the device while loopback is configured on any port, you receive an error message.
- The port loopback function shares hardware resources with the VLAN-mapping feature. If not enough TCAM resources are available because of VLAN-mapping configuration, when you attempt to configure loopback, you receive an error message, and the configuration is not allowed.
- If loopback is active on a port, you cannot add that port to a Flex Link pair or to an Ether Channel.

After you have configured Ethernet loopback, you enter the **ethernet loopback start** *interface-id* privileged EXEC command to begin the loopback. To stop loopback, enter the **ethernet loopback stop** {*interface-id* | **all**} command.

Examples

This example shows how to configure an Ethernet loopback to swap the MAC source and destination addresses and to time out after 30 seconds and to start the loopback process and verify the configuration. You must confirm the action before configuring.

```
Router(config)# interface gigabitethernet 0/1
Router(config-if)# ethernet loopback facility mac-address swap timeout 30 supported
Router(config-if)# end
Router# ethernet loopback start gigabitethernet 0/1
This is an intrusive loopback.
Therefore, while you test Ethernet connectivity,
you will be unable to pass traffic across that link.
Proceed with Local Loopback? [confirm]

Router# show ethernet loopback
====================================
Loopback Session 0  : Interface GI0/1
Direction           : facility
Type                : port
Status              : configured
MAC Mode            : swap
Time out            : 30
```

Related Commands

Command	Description
ethernet loopback (privileged EXEC)	Starts or stops an Ethernet loopback operation on an interface.
show ethernet loopback	Displays the Ethernet loopbacks configured on the switch or the specified interface.

ethernet loopback (privileged EXEC)

Use the **ethernet loopback** privileged EXEC command to start or stop an Ethernet loopback function on an interface.

ethernet loopback {**start** *interface-id* | **stop** {*interface-id* | **all**}}

Syntax Description

start	Start the Ethernet loopback operation configured on the interface.
stop	Stop the Ethernet loopback operation.
interface-id	Specify the interface on which to start or stop the loopback operation.
all	Stop all Ethernet loopback operations on the switch. This keyword is available only after the **stop** keyword.

Command Default

None.

Command Modes

Privileged EXEC

Command History

Release	Modification
15.1(1)MR	This command was introduced.

Usage Guidelines

Before starting or stopping an Ethernet loopback operation, you must configure it on an interface by entering the **ethernet loopback** interface configuration command. When you start loopback, you see a warning message.

You can configure and start or stop Ethernet loopback on physical ports only, not on VLANs or port channels.

Note This command is only supported on onboard Gigabit Ethernet ports.

You can configure only one loopback per port and a maximum of two loopbacks per device.

Examples

This example shows how to start a facility port loopback process, verify it, and then stop it:

```
Router(config)# interface gigabitethernet 0/1
Router(config-if)# ethernet loopback facility mac-address swap timeout 30 supported
Router(config-if)#emd
Router# ethernet loopback start gigabitethernet 0/1
This is an intrusive loopback.
Therefore, while you test Ethernet connectivity,
you will be unable to pass traffic across that link.
Proceed with Local Loopback? [confirm]
Router# show ethernet loopback
====================================
Loopback Session 0  : Interface GI0/1
```

```
Direction           : facility
Type                : port
Status              : active
MAC Mode            : swap
Time out            : 30

Router# ethernet loop stop all

Dec  4 11:18:44.083: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to up

Router# show ethernet loop
====================================
Loopback Session 0  : Interface Gi0/1
Direction           : facility
Type                : port
Status              : configured
MAC Mode            : swap
Time out            : 30
```

Related Commands

Command	Description
ethernet loopback (interface configuration)	Configures an Ethernet loopback operation on an interface.
show ethernet loopback	Displays the Ethernet loopbacks configured on the switch or the specified interface.

ethernet oam

To enable Ethernet operations, maintenance, and administration (OAM) on an interface, use the **ethernet oam** command in interface configuration mode. To disable Ethernet OAM on an interface, use the **no** form of this command.

ethernet oam [**max-rate** *oampdus* | **min-rate** *num-seconds* | **mode** {**active** | **passive**} | **timeout** *seconds*]

no ethernet oam [**max-rate** | **min-rate** | **mode** {**active** | **passive**} | **timeout**]

Syntax Description

max-rate	(Optional) Sets the maximum rate that OAM protocol data units (PDUs) can be sent per second.
oampdus	(Optional) Integer in the range of 1 to 10 that is the number of OAM PDUs transmitted. The default is 10 for the maximum rate.
min-rate	(Optional) Controls the minimum rate that OAM PDUs are transmitted, in seconds.
num-seconds	(Optional) Integer in the range of 1 to 10 that is the number of seconds during which at least one OAM PDU must be sent.
mode	(Optional) Sets the OAM client mode.
active	(Optional) Sets the OAM client mode to active after the interface was previously placed in passive mode. Active is the default.
passive	(Optional) Sets the OAM client mode to passive. In passive mode, a device cannot initiate discovery, inquire about variables, or set loopback mode.
timeout	(Optional) Specifies the amount of time, in seconds, after which a device declares its OAM peer to be nonoperational.
seconds	(Optional) Integer in the range of 2 to 30 that is the number of seconds of the timeout period. The default is 5.

Command Default

Ethernet OAM is disabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When Ethernet OAM is configured on an interface, the default mode of the OAM client is active. When the Ethernet OAM mode is enabled on two interfaces passing traffic, both interfaces cannot be in passive mode. Both interfaces can be in active mode, and one can be in active mode and the other in passive mode. You can toggle between Ethernet OAM modes without disabling OAM.

The **min-rate** *num-seconds* keyword and argument pair controls the minimum rate at which OAM PDUs can be sent on an interface, in seconds. A value of *n*, where 1 is less than or equal to *n* and *n* is less than or equal to 10, indicates that an OAM PDU must be sent at least once per *n* seconds. If no other OAM PDU is to be sent within an *n*-second window, an information OAM PDU must be sent.

Examples

The following example shows how to activate an Ethernet OAM interface that was previously configured to be in passive mode:

```
Router(config)# interface gigabitethernet 0/1
Router(config-if)# ethernet oam mode active
```

The following example shows how to set the maximum transmission rate of OAM PDUs on interface GigabitEthernet 0/1 to 5 transmissions per second:

```
Router(config)# interface gigabitethernet 0/1
Router(config-if)# ethernet oam max-rate 5
```

The following example shows how to set the timeout period to 25 seconds on interface GigabitEthernet 0/1:

```
Router(config)# interface gigabitethernet 0/1
Router(config-if)# ethernet oam timeout 25
```

ethernet oam link-monitor frame

To configure an error frame threshold or window on an Ethernet operations, maintenance, and administration (OAM) interface, use the **ethernet oam link-monitor frame** command in configuration template mode or interface configuration mode. To remove the threshold or window, use the **no** form of this command.

ethernet oam link-monitor frame {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*}

no ethernet oam link-monitor frame {**threshold** {**high** | **low**} | **window**}

Syntax Description

threshold	Sets a number of error frames at, above, or below which an action is triggered.
high	Sets a high error frame threshold in number of frames.
none	Disables a high threshold.
high-frames	Integer in the range of 1 to 65535 that is the high threshold in number of frames.
low	Sets a low error frame threshold.
low-frames	Integer in the range of 0 to 65535 that sets the low threshold in number of frames. The default is 1.
window	Sets a window and period of time during which error frames are counted.
milliseconds	Integer in the range of 10 to 600 that represents a number of milliseconds in a multiple of 100. The default is 100.

Command Default

The **ethernet oam link-monitor frame** command is not configured.

Command Modes

Configuration template (config-template)
Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **ethernet oam link-monitor frame** command configures a number of error frames that triggers an action or a period of time in which error frames are counted.

Examples

The following example shows how to configure an Ethernet OAM link-monitor frame window of 3000 milliseconds:

```
Router(config-template)# ethernet oam link-monitor frame window 300
```

Related Commands

ethernet oam link-monitor frame-period	Configures an error frame period on an Ethernet OAM interface.
ethernet oam link-monitor frame-seconds	Configures a frame-seconds period on an Ethernet OAM interface.
ethernet oam link-monitor high-threshold action	Configures a specific action to occur when a high threshold for an error is exceeded on an Ethernet OAM interface.
ethernet oam link-monitor receive-crc	Configures an Ethernet OAM interface to monitor frames received with CRC errors for a period of time.
ethernet oam link-monitor symbol-period	Configures an error symbol period on an Ethernet OAM interface.
ethernet oam link-monitor transmit-crc	Configures an Ethernet OAM interface to monitor frames transmitted with CRC errors for a period of time.

ethernet oam link-monitor frame-period

To configure an error frame period on an Ethernet operations, maintenance, and administration (OAM) interface, use the **ethernet oam link-monitor frame-period** command in configuration template or interface configuration mode. To remove the frame period, use the **no** form of this command.

ethernet oam link-monitor frame-period {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *frames*}

no ethernet oam link-monitor frame-period {**threshold** {**high** | **low**} | **window**}

Syntax Description

threshold	Sets a number of error frames for the period at, above, or below which an action is triggered.
high	Sets a high threshold for the error frame period in number of frames.
none	Disables a high threshold.
high-frames	Integer in the range of 1 to 65535 that is the high threshold in number of frames. There is no default. The high threshold must be configured.
low	Sets a low threshold for the error frame period in number of frames.
low-frames	Integer in the range of 0 to 65535 that is the low threshold in number of frames. The default is 1.
window	Sets a polling window and window size.
frames	Integer in the range of 1 to 65535 that is the window size in number of frames. Each value is a multiple of 10000. The default is 1000.

Command Default

The **ethernet oam link-monitor frame-period** command is not configured.

Command Modes

Configuration template (config-template)
Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **ethernet oam link-monitor frame-period** command configures an error frame period in number of frames. When a high threshold is configured, it must be at least as great as the low threshold for frame errors.

The number of frames polled is user defined. Note that the system can poll only by time, not by frames. The number of frames you specify is converted internally to seconds using a formula that includes interface speed.

Examples

The following example shows how to configure an Ethernet OAM link-monitor frame-period window of 20000 frames:

```
Router(config-template)# ethernet oam link-monitor frame-period window 2
```

The following example shows how to configure an Ethernet OAM link-monitor frame-period low threshold of 500 frames:

```
Router(config-template)# ethernet oam link-monitor frame-period threshold low 500
```

Related Commands

ethernet oam link-monitor frame	Configures an error frame threshold or window on an Ethernet OAM interface.
ethernet oam link-monitor frame-seconds	Configures a frame-seconds period on an Ethernet OAM interface.
ethernet oam link-monitor high-threshold action	Configures a specific action to occur when a high threshold for an error is exceeded on an Ethernet OAM interface.
ethernet oam link-monitor receive-crc	Configures an Ethernet OAM interface to monitor frames received with CRC errors for a period of time.
ethernet oam link-monitor symbol-period	Configures an error symbol period on an Ethernet OAM interface.
ethernet oam link-monitor transmit-crc	Configures an Ethernet OAM interface to monitor frames transmitted with CRC errors for a period of time.

ethernet oam link-monitor frame-seconds

To configure a frame-seconds period on an Ethernet operations, maintenance, and administration (OAM) interface, use the **ethernet oam link-monitor frame-seconds** command in configuration template and interface configuration mode. To remove the threshold or window, use the **no** form of this command.

ethernet oam link-monitor frame-seconds {**threshold** {**high** {**none** | *high-frames*} | **low** *low-frames*} | **window** *milliseconds*}

no ethernet oam link-monitor frame-seconds {**threshold** {**high** | **low**} | **window**}

Syntax Description

threshold	Sets a number at, above, or below which an action is triggered.
high	Sets a high error frame-seconds threshold in number of seconds.
none	Disables a high threshold.
high-frames	Integer in the range of 1 to 900 that is the high threshold in number of frames. There is no default. The high threshold must be configured.
low	Sets a low error frame-seconds threshold in number of seconds.
low-frames	Integer in the range of 1 to 900 that sets the low threshold in number of frames. The default is 1.
window	Sets a polling window during which error frames are counted.
milliseconds	Integer in the range of 100 to 9000 that represents a number of milliseconds in a multiple of 100. The default is 1000.

Command Default

The **ethernet oam link-monitor frame-seconds** command is not configured.

Command Modes

Configuration template (config-template)
Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **ethernet oam link-monitor frame-seconds** command configures a number of error frames that triggers an action or a period of time in which error frames are counted.

Examples

The following example shows how to configure an Ethernet OAM link-monitor frame-seconds window of 30000 milliseconds (30 seconds):

```
Router(config-template)# ethernet oam link-monitor frame-seconds window 300
```

Related Commands

ethernet oam link-monitor frame	Configures an error frame threshold or window on an Ethernet OAM interface.
ethernet oam link-monitor frame-period	Configures an error frame period on an Ethernet OAM interface.
ethernet oam link-monitor high-threshold action	Configures a specific action to occur when a high threshold for an error is exceeded on an Ethernet OAM interface.
ethernet oam link-monitor receive-crc	Configures an Ethernet OAM interface to monitor frames received with CRC errors for a period of time.
ethernet oam link-monitor symbol-period	Configures an error symbol period on an Ethernet OAM interface.
ethernet oam link-monitor transmit-crc	Configures an Ethernet OAM interface to monitor frames transmitted with CRC errors for a period of time.

ethernet oam link-monitor high-threshold action

To configure a specific action to occur when a high threshold for an error is exceeded on an Ethernet operations, maintenance, and administration (OAM) interface, use the **ethernet oam link-monitor high-threshold action** command in configuration template mode. To remove the high-threshold action, use the **no** form of this command.

ethernet oam link-monitor high-threshold action {**error-disable-interface** | **failover**}

no ethernet oam link-monitor high-threshold action

Syntax Description

error-disable-interface	Performs an error-disable function on the interface.
failover	Performs a failover to another port in the same PortChannel.

Command Default

A high-threshold action is not configured.

Command Modes

Configuration template (config-template)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **failover** keyword.

Usage Guidelines

The failover action is applicable only to EtherChannel interfaces. It provides an automatic failover of traffic from one port in an EtherChannel to another port in the same EtherChannel when one of the ports in the channel exceeds the high threshold for an error within the specified interval. The port failover occurs only if at least one operational port is in the EtherChannel. The failed port is put into an error-disable state. If the failed port is the last port in the EtherChannel, the port will not be put into the error-disable state and will continue to pass traffic regardless of the types of errors received.

Single, nonchanneling ports go into the error-disable state when the error high threshold is exceeded within the specified interval.

Examples

The following example shows how to configure an error-disable-interface action to occur when the high threshold for an error is exceeded:

```
Router(config-template)# ethernet oam link-monitor high-threshold action
error-disable-interface
```

Related Commands

ethernet oam link-monitor frame	Configures an error frame threshold or window on an Ethernet OAM interface.
ethernet oam link-monitor frame-period	Configures an error frame period on an Ethernet OAM interface.
ethernet oam link-monitor frame-seconds	Configures a frame-seconds period on an Ethernet OAM interface.
ethernet oam link-monitor receive-crc	Configures an Ethernet OAM interface to monitor frames received with CRC errors for a period of time.
ethernet oam link-monitor symbol-period	Configures an error symbol period on an Ethernet OAM interface.
ethernet oam link-monitor transmit-crc	Configures an Ethernet OAM interface to monitor frames transmitted with CRC errors for a period of time.

ethernet oam link-monitor on

To enable link monitoring on an Ethernet operations, maintenance, and administration (OAM) interface, use the **ethernet oam link-monitor on** command in interface configuration mode. To disable link monitoring, use the **no** form of this command.

ethernet oam link-monitor on

no ethernet oam link-monitor on

Syntax Description

This command has no arguments or keywords.

Command Default

Link monitoring is turned on when Ethernet OAM is enabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When link monitoring is enabled, the interface sends event OAM protocol data units (PDUs) when errors occur and interprets event OAM PDUs from the remote peer. Link monitoring can be effective only if both the local client and remote peer agree to support it.

The **ethernet oam link-monitor on** command is enabled by default when Ethernet OAM is enabled and does not display in the configuration when the **show running-config** command is issued.

When link monitoring is enabled by default, to turn it off you must explicitly disable it by issuing the **no** form of this command.

Examples

The following example shows how to disable link monitoring on Ethernet OAM interface Ethernet 0/1:

```
Router(config)# interface ethernet 0/1
Router(config-if)# no ethernet oam link-monitor on
```

Related Commands

ethernet oam link-monitor supported	Enables support for link monitoring on an Ethernet OAM interface.

ethernet oam link-monitor receive-crc

To configure an Ethernet operations, maintenance, and administration (OAM) interface to monitor ingress frames received with cyclic redundancy code (CRC) errors for a period of time, use the **ethernet oam link-monitor receive-crc** command in configuration template or interface configuration mode. To disable monitoring, use the **no** form of this command.

ethernet oam link-monitor receive-crc {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*}

no ethernet oam link-monitor receive-crc {**threshold** {**high** | **low**} | **window**}

Syntax Description

threshold	Sets a number of frames with CRC errors received at, above, or below which an action is triggered.
high	Sets a high threshold in number of frames.
high-frames	Integer in the range of 1 to 65535 that is the high threshold in number of frames.
none	Disables a high threshold.
low	Sets a low threshold.
low-frames	Integer in the range of 0 to 65535 that sets the low threshold in number of frames. The default is 10.
window	Sets a window and period of time during which frames with CRC errors are counted.
milliseconds	Integer in the range of 10 to 1800 that represents a number of milliseconds in a multiple of 100. The default is 1000.

Command Default

The **ethernet oam link-monitor receive-crc** command is not configured.

Command Modes

Configuration template (config-template)
Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

OAM must be operational on the interface before you issue this command.

Examples

The following example shows how to configure a receive-crc period with a low threshold of 3000:

```
Router(config-if)# ethernet oam link-monitor receive-crc threshold low 3000
```

Related Commands

ethernet oam link-monitor frame	Configures an error frame threshold or window on an Ethernet OAM interface.
ethernet oam link-monitor frame-period	Configures an error frame period on an Ethernet OAM interface.
ethernet oam link-monitor frame-seconds	Configures a frame-seconds period on an Ethernet OAM interface.
ethernet oam link-monitor high-threshold action	Configures a specific action to occur when a high threshold for an error is exceeded on an Ethernet OAM interface.
ethernet oam link-monitor symbol-period	Configures an error symbol period on an Ethernet OAM interface.
ethernet oam link-monitor transmit-crc	Configures an Ethernet OAM interface to monitor frames transmitted with CRC errors for a period of time.

ethernet oam link-monitor supported

To enable support for link monitoring on an Ethernet operations, maintenance, and administration (OAM) interface, use the **ethernet oam link-monitor supported** command in interface configuration mode. To disable link monitoring support, use the **no** form of this command.

ethernet oam link-monitor supported

no ethernet oam link-monitor supported

Syntax Description

This command has no arguments or keywords.

Command Default

Link monitoring is supported when Ethernet OAM is enabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to help establish an OAM session for performing OAM functions, such as remote loopback. For example, if your device is connected to a third-party device that does not support link monitoring, you must disable link monitoring support on your device to establish an OAM session with the third-party device.

When the **ethernet oam link-monitor supported** command has been issued, remote loopback will not function, whether or not an interface has been configured to support it.

The **ethernet oam link-monitor supported** command is enabled by default when Ethernet OAM is enabled and does not display in the configuration when the **show running-config** command is issued.

When support for link monitoring is enabled by default, to turn it off you must explicitly disable it by issuing the **no** form of this command.

Examples

The following example shows how to disable support for link monitoring on the GigabitEthernet 0/1 OAM interface:

```
Router(config)# interface gigabitethernet 0/1
Router(config-if)# no ethernet oam link-monitor supported
```

The following example shows how to reenable support for link monitoring on the GigabitEthernet 0/1 OAM interface after support has been disabled:

```
Router(config)# interface gigabitethernet 0/1
Router(config-if)# ethernet oam link-monitor supported
```

Related Commands

ethernet oam link-monitor on	Enables link monitoring on an Ethernet OAM interface.

ethernet oam link-monitor transmit-crc

To configure an Ethernet operations, maintenance, and administration (OAM) interface to monitor egress frames transmitted with cyclic redundancy code (CRC) errors for a period of time, use the **ethernet oam link-monitor transmit-crc** command in configuration template or interface configuration mode. To disable monitoring, use the **no** form of this command.

ethernet oam link-monitor transmit-crc {**threshold** {**high** {*high-frames* | **none**} | **low** *low-frames*} | **window** *milliseconds*}

no ethernet oam link-monitor transmit-crc {**threshold** {**high** | **low**} | **window**}

Syntax Description

threshold	Sets a number of frames with CRC errors transmitted at, above, or below which an action is triggered.
high	Sets a high threshold in number of frames.
high-frames	Integer in the range of 1 to 65535 that is the high threshold in number of frames.
none	Disables a high threshold.
low	Sets a low threshold.
low-frames	Integer in the range of 0 to 65535 that sets the low threshold in number of frames. The default is 10.
window	Sets a window and period of time during which frames with transmit CRC errors are counted.
milliseconds	Integer in the range of 10 to 1800 that represents a number of milliseconds in a multiple of 100. The default is 100.

Command Default

The **ethernet oam link-monitor transmit-crc** command is not configured.

Command Modes

Configuration template (config-template)
Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

OAM must be operational on the interface before you issue this command.

Examples

The following example shows how to configure a transmit CRC window of 2500 milliseconds:

```
Router(config-if)# ethernet oam link-monitor transmit-crc window 25
```

Related Commands

ethernet oam link-monitor frame	Configures an error frame threshold or window on an Ethernet OAM interface.
ethernet oam link-monitor frame-period	Configures an error frame period on an Ethernet OAM interface.
ethernet oam link-monitor frame-seconds	Configures a frame-seconds period on an Ethernet OAM interface.
ethernet oam link-monitor high-threshold action	Configures a specific action to occur when a high threshold for an error is exceeded on an Ethernet OAM interface.
ethernet oam link-monitor receive-crc	Configures an Ethernet OAM interface to monitor frames received with CRC errors for a period of time.
ethernet oam link-monitor symbol-period	Configures an error symbol period on an Ethernet OAM interface.

ethernet oam mib log size

To set the size of the Ethernet Operations, Administration, and Maintenance (OAM) event log table, use the **ethernet oam mib log size** command in global configuration mode. To remove the event log table, use the **no** form of this command.

ethernet oam mib log size *entries*

no ethernet oam mib log size

Syntax Description

entries	Number of entries that the event log table will hold. Integer from 0 to 200. The minimum is 0, the maximum is 200, and the default is 50.

Command Default

An event log table is not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to configure an OAM event log table.

Examples

The following example shows how to set the size of an event log table to 100 entries:

```
Router# configure terminal
Router(config)# ethernet oam mib log size 100
```

ethernet oam remote-failure action

To enable Ethernet Operations, Administration, and Maintenance (OAM) remote failure actions, use the **ethernet oam remote-failure action** command in interface configuration mode. To turn off remote failure actions, use the **no** form of this command.

ethernet oam remote-failure {**critical-event** | **dying-gasp** | **link-fault**} **action** {**error-block-interface** | **error-disable-interface**}

no ethernet oam remote-failure {**critical-event** | **dying-gasp** | **link-fault**} **action**

Syntax Description

critical-event	Specifies remote critical event failures.
dying-gasp	Specifies remote dying-gasp failures.
link-fault	Specifies remote link-fault failures.
error-block-interface	Sets the interface to the blocking state when an error occurs.
error-disable-interface	Disables the interface when an error occurs.

Command Default

Actions in response to Ethernet OAM remote failures do not occur.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.2(33)SXI	The **error-block-interface** keyword was added.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to configure an interface to take specific actions when Ethernet OAM remote-failure events occur.

Release 12.2(33)MRA does not support sending critical-event messages but can receive all three message types.

Examples

The following example shows how to configure the action that the Ethernet 1/1 interface takes when a critical event occurs:

```
Router# configure terminal
Router(config)# interface ethernet 1/1
Router(config-if)# ethernet oam remote-failure critical-event action
error-disable-interface
```

ethernet oam remote-loopback

To turn on or off Ethernet operations, maintenance, and administration (OAM) remote loopback functionality on an interface, use the **ethernet oam remote-loopback** command in privileged EXEC mode. This command does not have a no form.

ethernet oam remote-loopback {**start** | **stop**} {**interface** *type number*}

Syntax Description

start	Starts the remote loopback operation.
stop	Stops the remote loopback operation.
interface	Specifies an interface.
type	Type of Ethernet interface. Valid values are GigabitEthernet.
number	Integer from 1 to 9 that is the number of the Ethernet interface.

Command Default

Remote loopback functionality is turned off.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

There is no **no** form of this command.

When Ethernet OAM remote loopback functionality is enabled on an interface, traffic sent out on this interface will be discarded or sent back (and dropped locally) by the remote interface.

Remote loopback will not function, whether or not an interface has been configured to support it, when the **no ethernet oam link-monitor supported** command has been issued.

Note To start Ethernet OAM remote loopback on a switch port, you must first configure the **access-group mode prefer port** command in interface configuration mode.

Examples

The following example shows how to start a remote loopback session on interface GigabitEthernet 2/1:

```
Router# ethernet oam remote-loopback start interface gigabitethernet2/1
```

Related Commands

access-group mode prefer port	Specifies the override modes and the nonoverride modes for an access group and specifies that the PACL mode takes precedence if PACLs are configured.
ethernet oam remote-loopback (interface)	Enables the support of Ethernet OAM remote loopback operation on an interface or sets a remote loopback timeout period.

ethernet oam remote-loopback (interface)

To enable the support of Ethernet operations, maintenance, and administration (OAM) remote loopback operations on an interface or set a remote loopback timeout period, use the **ethernet oam remote-loopback (interface)** command in interface configuration mode. To disable support or remove the timeout setting, use the **no** form of this command.

ethernet oam remote-loopback {**supported** | **timeout** *seconds*}

no ethernet oam remote-loopback {**supported** | **timeout**}

Syntax Description

supported	Supports the remote loopback functionality.
timeout	Sets a master loopback timeout setting.
seconds	Integer from 1 to 10 that is the number seconds of the timeout period.

Command Default

Remote loopback is not supported.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command enables the support of OAM remote-loopback on an interface. Only after this functionality is enabled can the local OAM client initiate the OAM remote loopback operation. Changing this setting causes the local OAM client to exchange configuration information with its remote peer.

The **no** form of the command is rejected if the interface is in the loopback mode.

Note To start Ethernet OAM remote loopback on a switch port, you must first configure the **access-group mode prefer port** command in interface configuration mode.

Examples

The following example shows how to enable remote loopback support on interface GigabitEthernet 2/1:

```
Router(config)# interface gigabitethernet 2/1
Router(config-if)# ethernet oam remote-loopback supported
```

Related Commands

access-group mode prefer port	Specifies the override modes and the nonoverride modes for an access group and specifies that the PACL mode takes precedence if PACLs are configured.
ethernet oam remote-loopback	Turns on or off the remote loopback functionality.

fair-queue (class-default)

To specify the number of dynamic queues to be reserved for use by the class-default class as part of the default class policy, use the **fair-queue** command in policy-map class configuration mode. To delete the configured number of dynamic queues from the class-default policy, use the **no** form of this command.

fair-queue [*number-of-dynamic-queues*]

no fair-queue [*number-of-dynamic-queues*]

Syntax Description

number-of-dynamic-queues	(Optional) A power of 2 that specifies the number of dynamic queues. Range is from 16 to 4096.

Command Default

The number of dynamic queues is derived from the interface or ATM permanent virtual circuit (PVC) bandwidth. See Table 1-2 in the "Usage Guidelines" section for the default number of dynamic queues that weighted fair queueing (WFQ) and class-based WFQ (CBWFQ) use when they are enabled on an interface. See Table 1-3 in the "Usage Guidelines" section for the default number of dynamic queues used when WFQ or CBWFQ is enabled on an ATM PVC.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command can be used for the default class (commonly known as the class-default class) only. You can use it in conjunction with the **queue-limit** command.

The class-default class is the default class to which traffic is directed if that traffic does not satisfy the match criteria of other classes whose policy is defined in the policy map.

Table 1-2 lists the default number of dynamic queues that class-based WFQ (CBWFQ) uses when it is enabled on an interface.

Table 1-2 Default Number of Dynamic Queues as a Function of Interface Bandwidth

Bandwidth Range	Number of Dynamic Queues
Less than or equal to 64 kbps	16
More than 64 kbps and less than or equal to 128 kbps	32
More than 128 kbps and less than or equal to 256 kbps	64
More than 256 kbps and less than or equal to 512 kbps	128
More than 512 kbps	256

Table 1-3 lists the default number of dynamic queues used when CBWFQ is enabled on an ATM PVC.

Table 1-3 Default Number of Dynamic Queues as a Function of ATM PVC Bandwidth

Bandwidth Range	Number of Dynamic Queues
Less than or equal to 128 kbps	16
More than 128 kbps and less than or equal to 512 kbps	32
More than 512 kbps and less than or equal to 2000 kbps	64
More than 2000 kbps and less than or equal to 8000 kbps	128
More than 8000 kbps	256

Examples

The following example configures policy for the default class included in the policy map called policy9. Packets that do not satisfy match criteria specified for other classes whose policies are configured in the same service policy are directed to the default class, for which 16 dynamic queues have been reserved. Because the **queue-limit** command is configured, tail drop is used for each dynamic queue when the maximum number of packets are enqueued and additional packets arrive.

```
policy-map policy9
 class class-default
 fair-queue 16
 queue-limit 20
```

Related Commands

Command	Description
queue-limit	Specifies or modifies the maximum number of packets the queue can hold for a class policy configured in a policy map.

fair-queue (policy-map class)

To specify the number of queues to be reserved for use by a traffic class, use the **fair-queue** command in policy-map class configuration mode. To delete the configured number of queues from the traffic class, use the **no** form of this command.

fair-queue [*dynamic-queues*]

no fair-queue [*dynamic-queues*]

Syntax Description

dynamic-queues	(Optional) A number specifying the number of dynamic conversation queues. The number can be in the range of 16 to 4096.

Command Default

No queues are reserved.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE and implemented on Versatile Interface Processor (VIP)-enabled Cisco 7500 series routers.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T and was implemented on VIP-enabled Cisco 7500 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

On a VIP, the **fair-queue** command can be used for any traffic class (as opposed to non-VIP platforms, which can only use the **fair-queue** command in the default traffic class). The **fair-queue** command can be used in conjunction with the **queue-limit** command.

Examples

The following example configures the default traffic class for the policy map called policy9 to reserve ten queues for packets that do not satisfy match criteria specified for other traffic classes whose policy is configured in the same service policy. Because the **queue-limit** command is configured, tail drop is used for each queue when the maximum number of packets is enqueued and additional packets arrive.

```
policy-map policy9
 class class-default
 fair-queue 10
 queue-limit 20
```

Related Commands

Command	Description
class class-default	Specifies the default traffic class for a service policy map.
queue-limit	Specifies or modifies the maximum number of packets the queue can hold for a class policy configured in a policy map.

id (CFM)

To configure a maintenance domain identifier (MDID), use the **id** command in Ethernet connectivity fault management (CFM) configuration mode. To remove a MDID, use the **no** form of this command.

id {*mac-address domain-number* | **dns** *dns-name* | **null**}

no id

Syntax Description

mac-address	MAC address of the maintenance domain.
domain-number	Integer in the range of 0 to 65535.
dns	Specifies a domain name service (DNS).
dns-name	String of a maximum of 43 characters.
null	Indicates there is not a domain name.

Command Default

A MDID is not configured.

Command Modes

Ethernet CFM configuration (config-ecfm)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If the MDID is not specified, the domain name in string format is used as the default. If a DNS name exceeds 43 characters, the MDID is only the first 43 characters of that DNS name.

If the MDID is explicitly null, the maintenance association ID (MAID) is constructed from the short maintenance association name. The short maintenance association name needs to be unique globally if the MDID is null.

Examples

The following example shows how to configure a MDID with a MAC address and a domain number:

```
Router(config)# ethernet cfm domain customerA level 5
Router(config-ecfm)# id aaaa.bbbb.cccc 1017
```

idle-pattern

To specify the data pattern transmitted on the T1/E1 line when missing packets are detected on the PWE3 circuit, use the **idle-pattern** command in CEM configuration mode. To stop sending idle pattern data, use the **no** form of this command.

idle-pattern [*pattern*]

no idle-pattern

Syntax Description

pattern	(Optional) An 8-bit hexadecimal number that is transmitted as the idle pattern. T1 and E1 channels require only this argument.

Defaults

For T1 or E1 channels, the default idle pattern is 0xFF.

Command Modes

CEM circuit configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The idle-pattern data is sent to replace the data from missing packets.

Examples

The following example shows how to specify a data pattern:

```
Router# config t
Router(config)# interface cem 0/0
Router(config-if)# no ip address
Router(config-if)# cem 0
Router(config-if-cem)# idle-pattern 0x55
Router(config-if-cem)# xconnect 10.10.10.10 200 encapsulation mpls
Router(config-if-cem-xconn)# exit
Router(config-if-cem)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
cem	Enters circuit emulation configuration mode.

Command	Description
cem class	Applies the CEM interface parameters defined in the given CEM class name to the circuit.
class cem	Configures CEM interface parameters in a class that's applied to CEM interfaces together in global configuration mode.

ima-group

To define physical links as inverse multiplexing over ATM (IMA) group members, use the **ima-group** command in interface configuration mode. When you first perform the configuration or when you change the group number, the interface is automatically disabled, moved to the new group, and then enabled. To remove the group, use the **no** form of this command.

ima-group *group-number*

no ima-group *group-number*

Syntax Description

group-number	Specifies an IMA group number from 0 to 3. IMA groups can span multiple ports on a port adapter or shared port adapter (SPA) but cannot span port adapters or SPAs.

Defaults

No IMA groups are defined.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS Release 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4 (11)XJ	This command was integrated into Cisco IOS Release 12.4 (11)XJ.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(33)SRB2	Support for Cisco 7600 series routers was added.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **ima-group** interface command to configure a T1/E1 IMA port adapter interface as part of an IMA group.

Examples

The following example shows how to define an IMA group:

```
Router(config)# interface ATM0/0
```

```
Router(config-if)# no ip address
Router(config-if)# no atm ilmi-keepalive
Router(config-if)# ima-group 0
```

Related Commands

Command	Description
interface atm	Configures an ATM interface.
interface atm ima	Configures an ATM IMA group.
show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.

instance (VLAN)

To map a VLAN or a group of VLANs to a multiple spanning tree (MST) instance, use the **instance** command in MST configuration mode. Use the **no** form of this command to return the VLANs to the default command and internal spanning tree (CIST).

instance *instance-id* {**vlans** *vlan-range*}

no instance *instance-id*

Syntax Description

instance-id	Instance to which the specified VLANs are mapped; valid values are from 0 to 4094.
vlans *vlan-range*	Specifies the number of the VLANs to be mapped to the specified instance; valid values are from 1 to 4094.

Defaults

No VLANs are mapped to any MST instance (all VLANs are mapped to the CIST instance).

Command Modes

MST configuration mode (config-mst)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Cisco IOS Release 12.2 (17d)SXB.
12.2(18)SXF	This command was changed as follows: • You can configure up to 65 interfaces. • You can designate the *instance-id* from 1 to 4094.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **vlans** *vlan-range* is entered as a single value or a range.

The mapping is incremental, not absolute. When you enter a range of VLANs, this range is added or removed to the existing instances.

Any unmapped VLAN is mapped to the CIST instance.

Examples

The following example shows how to map a range of VLANs to instance 2:

```
Router# configure terminal
Router(config)# spanning-tree mst configuration
Router(config-mst)# instance 2 vlan 1-100
Router(config-mst)#
```

The following example shows how to map a VLAN to instance 5:

```
Router(config-mst)# instance 5 vlan 1100
Router(config-mst)#
```

The following example shows how to move a range of VLANs from instance 2 to the CIST instance:

```
Router(config-mst)# no instance 2 vlan 40-60
Router(config-mst)#
```

The following example shows how to move all the VLANs that are mapped to instance 2 back to the CIST instance:

```
Router(config-mst)# no instance 2
Router(config-mst)#
```

Related Commands

Command	Description
name (MST configuration mode)	Sets the name of an MST region.
revision	Sets the revision number for the MST configuration.
show	Verifies the MST configuration.
show spanning-tree mst	Displays the information about the MST protocol.
spanning-tree mist configuration	Enters MST configuration mode.

interface atm ima

To configure an ATM IMA group and enter interface configuration mode, use the **interface atm ima** global configuration command. If the group does not exist when the command is issued, the command automatically creates the group.

interface atm *slot*/**ima***group-number*

Syntax Description

slot	Specifies the slot location of the ATM IMA port adapter.
group-number	Specifies an IMA group number from 0 to 3. You can create up to four groups.

Defaults

The interface includes individual ATM links, but no IMA groups.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(19)MR2	This command was incorporated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When a port is configured for IMA functionality, it no longer operates as an individual ATM link. Specifying ATM links as members of a group using the **ima-group** interface command does not enable the group. You must use the **interface atm** *slot*/**ima***group-number* command to create the group.

Examples

The following example shows the how to create the IMA group:

```
Router(config)# interface ATM0/IMA0
Router(config-if)# no ip address
```

Related Commands

Command	Description
ima-group	Configures the physical links as IMA group members; execute this interface configuration command for each physical link that you include in an IMA group.
ima group-id	Enables the user to configure the IMA Group ID for the IMA interface.
interface atm	Configures physical links for an ATM interface.
show ima interface atm	Displays general and detailed information about IMA groups and the links they include.

ip cef load-sharing algorithm

To select a Cisco Express Forwarding load-balancing algorithm, use the **ip cef load-sharing algorithm** command in global configuration mode. To return to the default universal load-balancing algorithm, use the **no** form of this command.

ip cef load-sharing algorithm {**original** | **tunnel** [*id*] | **universal** [*id*] | **include-ports** {**source** [*id*] | [**destination**] [*id*] | **source** [*id*] **destination** [*id*]}}

no ip cef load-sharing algorithm

Syntax Description

original	Sets the load-balancing algorithm to the original algorithm based on a source and destination hash.
tunnel	Sets the load-balancing algorithm for use in tunnel environments or in environments where there are only a few IP source and destination address pairs.
id	(Optional) Fixed identifier.
universal	Sets the load-balancing algorithm to the universal algorithm that uses a source and destination and an ID hash.
include-ports source	Sets the load-balancing algorithm to the include-ports algorithm that uses a Layer 4 source port.
include-ports destination	Sets the load-balancing algorithm to the include-ports algorithm that uses a Layer 4 destination port.
include-ports source destination	Sets the load balancing algorithm to the include-ports algorithm that uses Layer 4 source and destination ports.

Command Default

The universal load-balancing algorithm is selected. If you do not configure the fixed identifier for a load-balancing algorithm, the router automatically generates a unique ID.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.0(12)S	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(11)T	The **include-ports source**, **include-ports destination**, and the **include-ports source destination** keywords were added for the command.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The original Cisco Express Forwarding load-balancing algorithm produced distortions in load sharing across multiple routers because of the use of the same algorithm on every router. When the load-balancing algorithm is set to universal mode, each router on the network can make a different load sharing decision for each source-destination address pair, and that resolves load-balancing distortions.

The tunnel algorithm is designed to share the load more fairly when only a few source-destination pairs are involved.

The include-ports algorithm allows you to use the Layer 4 source and destination ports as part of the load-balancing decision. This method benefits traffic streams running over equal-cost paths that are not loadshared because the majority of the traffic is between peer addresses that use different port numbers, such as Real-Time Protocol (RTP) streams. The include-ports algorithm is available in Cisco IOS Release 12.4(11)T and later releases.

Examples

The following example shows how to enable the Cisco Express Forwarding load-balancing algorithm for tunnel environments:

```
Router# configure terminal
Router(config)# ip cef load-sharing algorithm tunnel
Router(config)# exit
```

Related Commands

Command	Description
debug ip cef hash	Records Cisco Express Forwarding load-balancing hash algorithm events
ip load-sharing	Enables load balancing for Cisco Express Forwarding.

ip load-sharing

To enable load balancing for Cisco Express Forwarding (CEF), use the **ip load-sharing** command in interface configuration mode.

ip load-sharing [**per-destination**]

Syntax Description

per-destination	(Optional) Enables per-destination load balancing on the interface.

Defaults

Per-destination load balancing is enabled by default when you enable CEF.

Command Modes

Interface configuration

Command History

Release	Modification
11.2 GS	This command was introduced.
11.1 CC	Multiple platform support was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **per-packet** keyword.

Usage Guidelines

Per-packet load balancing allows the router to send data packets over successive equal-cost paths without regard to individual destination hosts or user sessions. Path utilization is good, but packets destined for a given destination host might take different paths and might arrive out of order.

Per-destination load balancing allows the router to use multiple, equal-cost paths to achieve load sharing. Packets for a given source-destination host pair are guaranteed to take the same path, even if multiple, equal-cost paths are available. Traffic for different source-destination host pairs tend to take different paths.

Note If you want to enable per-packet load sharing to a particular destination, then all interfaces that can forward traffic to the destination must be enabled for per-packet load sharing.

Examples

The following example shows how to enable per-packet load balancing:

```
Router(config)# interface E0
Router(config-if)# ip load-sharing per-packet
```

The following example shows how to enable per-destination load balancing:

```
Router(config)# interface E0
Router(config-if)# ip load-sharing per-destination
```

Related Commands

Command	Description
ip cef	Enables CEF on the RP card.

ip local interface

To configure the IP address of the provider edge (PE) router interface to be used as the source IP address for sending tunneled packets, use the **ip local interface** command in pseudowire-class configuration mode. To remove the IP address, use the **no** form of this command.

ip local interface *interface-name*

no ip local interface *interface-name*

Syntax Description

interface-name	Name of the PE interface whose IP address is used as the source IP address for sending tunneled packets over a Layer 2 PW.

Defaults

No IP address is configured.

Command Modes

Pseudowire-class configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the same local interface name for all pseudowire-classes configured between a pair of PE routers. It is highly recommended that you configure a loopback interface with this command. If you do not, the router chooses the "best available local address," which could be any IP address configured on a core-facing interface. This configuration could prevent a control channel from being established.

Examples

The following example shows how to configure the IP address of the local loopback 0 as the source IP address for sending packets through an MPLS session:

```
Router# config t
Router(config)# pseudowire-class mpls
Router(config-pw-class)# ip local interface loopback 0
Router(config-pw-class)# exit
Router(config)# exit
```

Related Commands

Command	Description
ima-group	Configures the physical links as IMA group members, which executes the interface configuration command for each physical link included in an IMA group.
ima group-id	Enables the user to configure the IMA Group ID for the IMA interface.
interface atm	Configures physical links for an ATM interface.
show ima interface atm	Displays general and detailed information about IMA groups and the links they include.

ip multicast-routing

To enable IP multicast routing, use the **ip multicast-routing** command in global configuration mode. To disable IP multicast routing, use the **no** form of this command.

ip multicast-routing [**vrf** *vrf-name*]

no ip multicast-routing [**vrf** *vrf-name*]

Syntax Description

vrf *vrf-name*	(Optional) Enables IP multicast routing for the Multicast Virtual Private Network (VPN) routing and forwarding (MVRF) instance specified for the *vrf-name* argument.

Defaults

IP multicast routing is disabled.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
11.2(11)GS	The distributed keyword was added.
12.0(5)T	The effect of this command was modified. If IP multicast Multilayer Switching (MLS) is enabled, using the no form of this command now disables IP multicast routing on the Multicast MultiLayer Switching (MMLS) route processor (RP) and purges all multicast MLS cache entries on the MMLS-SE.
12.0(23)S	The vrf keyword and vrf-name argument were added.
12.2(13)T	The vrf keyword and vrf-name argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	Support for this command was introduced on the Supervisor Engine 720.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When IP multicast routing is disabled, the Cisco IOS software does not forward any multicast packets.

Examples

The following example shows how to enable IP multicast routing:

```
Router(config)# ip multicast-routing
```

The following example shows how to enable IP multicast routing for a specific VRF:

```
Router(config)# ip multicast-routing vrf vrf1
```

The following example shows how to disable IP multicast routing:

```
Router(config)# no ip multicast-routing
```

Related Commands

Command	Description
ip pim	Enables PIM on an interface.

ip ospf bfd

To enable Bidirectional Forwarding Detection (BFD) on a specific interface configured for Open Shortest Path First (OSPF), use the **ip ospf bfd** command in interface configuration mode. To disable BFD on the OSPF interface, use the **disable** keyword. To remove the **ip ospf bfd** command, use the **no** form of this command.

ip ospf bfd [**disable**]

no ip ospf bfd

Syntax Description

disable	(Optional) Disables BFD for OSPF on a specified interface.

Defaults

When the **disable** keyword is not used, the default behavior is to enable BFD support for OSPF on the interface.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.4(4)T	This command was integrated into Cisco IOS Release 12.4(4)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Enter the **ip ospf bfd** command to configure an OSPF interface to use BFD for failure detection. If you have used the **bfd-all interfaces** command in router configuration mode to globally configure all OSPF interfaces for an OSPF process to use BFD, you can enter the **ip ospf bfd** command in interface configuration mode with the **disable** keyword to disable BFD for a specific OSPF interface.

Examples

In the following example, the interface associated with OSPF, Fast Ethernet interface 3/0, is configured for BFD:

```
Router> enable
Router# configure terminal
Router(config)# interface gigabitethernet 3/0
Router(config-if)# ip ospf bfd
Router(config-if)# end
```

Related Commands

Command	Description
bfd all-interfaces	Enables BFD for all interfaces for a BFD peer.

ip pim

To enable Protocol Independent Multicast (PIM) on an interface, use the **ip pim** command in interface configuration mode. To disable PIM on the interface, use the **no** form of this command.

ip pim {sparse-mode | sparse-dense-mode | dense-mode [proxy-register {list *access-list* **| route-map** *map-name*}]}

no ip pim {sparse-mode | sparse-dense-mode | dense-mode [proxy-register {list *access-list* **| route-map** *map-name*}]}

Syntax Description

sparse-mode	Enables sparse mode of operation.
sparse-dense-mode	Treats the interface in either sparse mode or dense mode of operation, depending on which mode the multicast group operates in.
dense-mode	Enables dense mode of operation.
proxy-register	(Optional) Enables proxy registering on the interface of a designated router (DR) (leading toward the bordering dense mode region) for multicast traffic from sources not connected to the DR.
list *access-list*	(Optional) Defines the extended access list number or name.
route-map *map-name*	(Optional) Defines the route map.

Defaults

IP multicast routing is disabled on all interfaces.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.1	The **sparse-dense-mode** keyword was added.
12.0 S	The following keywords and arguments were added: • proxy-register • list access-list • route-map map-name
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Enabling PIM on an interface also enables Internet Group Management Protocol (IGMP) operation on that interface. An interface can be configured to be in dense mode, sparse mode, or sparse-dense mode. The mode describes how the Cisco IOS software populates its multicast routing table and how the software forwards multicast packets it receives from its directly connected LANs. Dense mode interfaces are always added to the table when the multicast routing table is populated. Sparse mode interfaces are added to the table only when periodic join messages are received from downstream routers, or there is a directly connected member on the interface.

Dense Mode

Initially, a dense mode interface forwards multicast packets until the router determines that there are group members or downstream routers, or until a prune message is received from a downstream router. Then, the dense mode interface periodically forwards multicast packets out the interface until the same conditions occur. Dense mode assumes that multicast group members are present. Dense mode routers never send a join message. They do send prune messages as soon as they determine they have no members or downstream PIM routers. A dense mode interface is subject to multicast flooding by default.

Dense Mode with Proxy Registering

For a router in a PIM sparse mode (PIM-SM) domain configured to operate in sparse mode or sparse-dense mode, the ip pim dense-mode proxy-register command must be configured on the interface leading toward the bordering dense mode region. This configuration will enable the router to register traffic from the dense mode region with the rendezvous point (RP) in the sparse mode domain.

This command requires an extended access list or route map argument specifying which traffic the router needs to register with the RP. This command applies only to sources reachable through a PIM router. Cisco IOS software will always register traffic from remote sources if it arrives on a dense mode interface and if the Reverse Path Forwarding (RPF) neighbor leading toward the source is a Distance Vector Multicast Routing Protocol (DVMRP) but not a PIM router. This functionality has existed since Cisco IOS Release 10.0 and cannot be modified (restricted) with an access list or route map.

Sparse Mode

A sparse mode interface is used for multicast forwarding only if a join message is received from a downstream router or if group members are directly connected to the interface. Sparse mode assumes that no other multicast group members are present. When sparse mode routers want to join the shared path, they periodically send join messages toward the RP. When sparse mode routers want to join the source path, they periodically send join messages toward the source; they also send periodic prune messages toward the RP to prune the shared path.

Sparse-Dense Mode

An alternative to choosing just dense mode or just sparse mode is to run PIM in a single region in sparse mode for some groups and dense mode for other groups.

In sparse-dense mode, if the group is in dense mode, the interface will be treated as dense mode. If the group is in sparse mode, the interface will be treated in sparse mode. The group is "sparse" if the router knows about an RP for that group.

When an interface is treated in dense mode, it is populated in the outgoing interface list of the multicast routing table when either of the following conditions is true:

- Members or DVMRP neighbors are on the interface.
- Any of the PIM neighbors on the interface have not pruned for the group.

When an interface is treated in sparse mode, it is populated in the outgoing interface list of the multicast routing table when either of the following conditions is true:

- Members or DVMRP neighbors are on the interface.
- A PIM neighbor on the interface has received an explicit join message.

Examples

The following example shows how to enable PIM-SM on tunnel interface 0 and set the address of the RP router to 226.0.0.8:

```
ip pim rp-address 226.0.0.8
interface tunnel 0
ip pim sparse-mode
```

The following example shows how to enable PIM dense mode (PIM-DM) on Ethernet interface 1:

```
interface ethernet 1
ip pim dense-mode
```

The following example shows how to enable PIM sparse-dense mode on Ethernet interface 1:

```
interface ethernet 1
ip pim sparse-dense-mode
```

The following example shows how to register the multicast traffic for any source and any multicast group:

```
interface ethernet 0
ip address 172.16.0.0 255.255.255.0
description Ethernet interface towards the PIM sparse-mode domain
ip pim sparse-dense-mode
!
interface ethernet 1
ip address 192.44.81.5 255.255.255.0
description Ethernet interface towards the PIM dens-mode region
ip pim dense-mode proxy-register list 100
!
access-list 100 permit ip any any
```

Related Commands

Command	Description
ip multicast-routing	Enables IP multicast routing or multicast distributed switching.
ip pim rp-address	Configures the address of a PIM RP for a particular group.

ip pim rp-address

To statically configure the address of a Protocol Independent Multicast (PIM) rendezvous point (RP) for multicast groups, use the **ip pim rp-address** command in global configuration mode. To remove an RP address, use the **no** form of this command.

ip pim [**vrf** *vrf-name*] **rp-address** *rp-address* [*access-list*] [**override**]

no ip pim [**vrf** *vrf-name*] **rp-address** *rp-address* [*access-list*] [**override**]

Syntax Description

vrf *vrf-name*	(Optional) Specifies that the static group-to-RP mapping be associated with the Multicast Virtual Private Network (MVPN) routing and forwarding (MVRF) instance specified for the *vrf-name* argument.
rp-address	IP address of the RP to be used for the static group-to-RP mapping. This is a unicast IP address in four-part dotted-decimal notation.
access-list	(Optional) Number or name of a standard access list that defines the multicast groups to be statically mapped to the RP. **Note** If no access list is defined, the RP will map to all multicast groups, 224/4.
override	(Optional) Specifies that if dynamic and static group-to-RP mappings are used together and there is an RP address conflict, the RP address configured for a static group-to-RP mapping will take precedence. **Note** If the **override** keyword is not specified and there is RP address conflict, dynamic group-to-RP mappings will take precedence over static group-to-RP mappings.

Command Default

No PIM static group-to-RP mappings are configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
10.2	This command was introduced.
11.1	The **override** keyword was added.
12.1(2)T	The **bidir** keyword was added.
12.0(23)S	The **vrf** keyword and *vrf-name* argument were added.
12.2(13)T	The **vrf** keyword and *vrf-name* argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Release	Modification
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was incorporated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

In the Cisco IOS implementation of PIM, each multicast group individually operates in one of the following modes: dense mode, sparse mode, or sparse-dense mode. Groups in sparse mode (PIM-SM) use RPs to connect sources and receivers. All routers in a PIM domain need to have a consistent configuration for the mode and RP addresses of the multicast groups.

The Cisco IOS software learns the mode and RP addresses of multicast groups through the following three mechanisms: static group-to-RP mapping configurations, Auto-RP, and bootstrap router (BSR). By default, groups will operate in dense mode. No commands explicitly define groups to operate in dense mode.

Use the **ip pim rp-address** command to statically define the RP address for PIM-SM or bidir-PIM groups (an **ip pim rp-address** command configuration is referred to as a static group-to-RP mapping).

You can configure a single RP for more than one group using an access list. If no access list is specified, the static RP will map to all multicast groups, 224/4.

You can configure multiple RPs, but only one RP per group range.

If multiple **ip pim rp-address** commands are configured, the following rules apply:

- Highest RP IP address selected regardless of reachability: If a multicast group is matched by the access list of more than one configured **ip pim rp-address** command, then the RP for the group is determined by the RP with the highest RP address configured.
- One RP address per command: If multiple **ip pim rp-address** commands are configured, each static group-to-RP mapping must be configured with a unique RP address (if not, it will be overwritten).This restriction also means that only one RP address can be used to provide RP functions for either sparse mode or bidirectional mode groups. If you want to configure static group-to-RP mappings for both bidirectional and sparse mode, the RP addresses must be unique for each mode.
- One access list per command: If multiple **ip pim rp-address** commands are configured, only one access list can be configured per static group-to-RP mapping. An access list cannot be reused with other static group-to-RP mappings configured on a router.

If dynamic and static group-to-RP mappings are used together, the following rule applies to a multicast group: Dynamic group-to-RP mappings take precedence over static group-to-RP mappings—unless the **override** keyword is used.

Examples

The following example shows how to set the PIM RP address to 192.168.0.1 for all multicast groups (224/4) and defines all groups to operate in sparse mode:

```
ip pim rp-address 192.168.0.1
```

Note The RP address used for static group-to-RP mappings must be unique. You cannot use the same RP address for both bidir-PIM and PIM-SM groups.

ip rtp header-compression

To enable Real-Time Transport Protocol (RTP) header compression, use the **ip rtp header-compression** command in interface configuration mode. To disable RTP header compression, use the **no** form of this command.

ip rtp header-compression [**passive** | **iphc-format** | **ietf-format**] [**periodic-refresh**]

no ip rtp header-compression [**passive** | **iphc-format** | **ietf-format**] [**periodic-refresh**]

Syntax Description

passive	Compress only for destinations which send compressed headers.
iphc-format	Compress using IPHC format.
ietf-format	Specifies the Internet Engineering Task Force (IETF) format of header compression.
periodic-refresh	(Optional) Indicates that the compressed IP header will be refreshed periodically.

Defaults

This command is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.
12.0	This command was integrated into Cisco IOS Release 12.0. This command was modified to include the **iphc-format** keyword.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T. This command was modified to include the **periodic-refresh** keyword.
12.3(4)T	This command was modified to include the **ietf-format** keyword.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR and the ability to use the command to support distributed IPHC on a multilink interface was added.

Usage Guidelines

You can compress IP/User Datagram Protocol (UDP)/RTP headers to reduce the size of your packets. Compressing headers is especially useful for RTP because RTP payload size can be as small as 20 bytes, and the uncompressed header is 40 bytes.

ietf-format Keyword

The **ietf-format** keyword indicates that the IETF format of header compression will be used. For HDLC interfaces, the **ietf-format** keyword compresses only UDP packets. For PPP interfaces, when the **ietf-format** keyword is specified, TCP header compression is also enabled. For this reason, the **ip tcp header-compression** command appears in the output of the **show running-config** command. Because both RTP header compression and TCP header compression are enabled, both UDP packets and TCP packets are compressed.

Note The Cisco MWR 2941 supports UDP header-compression in IEFT format only.

With the **ietf-format** keyword, any even destination port number higher than 1024 can be used. Valid RTP packets that meet the criteria (that is, the port number is even and is higher than 1024) are compressed using the compressed RTP packet format. Otherwise, packets are compressed using the less-efficient compressed non-TCP packet format.

Note The header compression format (in this case, IETF) must be the same at *both* ends of the network. That is, if you specify the **ietf-format** keyword on the local router, you must also specify the **ietf-format** keyword on the remote router.

Support for Distributed IPHC on Multilink Interfaces

You can use the configure distributed IPHC (dIPHC) on a multilink interface for improved Multilink Point-to-Point Protocol (MLPPP) performance.

Distributed IP Header Compression (dIPHC) allows the Cisco MWR 2941 to compress IP packet headers for more efficient use of bandwidth. Release 3.5 improves dIPHC performance by shifting processing from the main CPU to the network processor.

When using the **ip rtp header-compression ietf-format** command for dIPHC on a multilink interface, note the following:

- The Cisco MWR 2941 supports for UDP traffic only.
- The Cisco MWR 2941 supports up to 300 dIPHC sessions over 3 multilinks.
- The Cisco MWR 2941 supports only the IEFT format of IPHC.
- The Cisco MWR 2941 supports dIPHC only for UDP traffic.
- After enabling dIPHC on an interface, ensure that you “flap” the interface by using the **shutdown** and **no shutdown** commands in interface configuration mode for the configuration to take effect.
- If a QoS policy is attached to the multilink interface on which IPHC has been enable, ensure that you configure the **platform header-compression match access-group** command in interface configuration mode to apply an extended named Access Control List (ACL) of static flows (source IP address, destination IP address, and destination port) to compress using IPHC.

  You must configure the matching ACL as an extended named access-list and add the static flow configuration to a Multilink interface that is in an UP state and on which the **ip rtp header-compression** command is configured.

Support for Serial Lines

RTP header compression is supported on serial lines using Frame Relay, HDLC, or PPP encapsulation. You must enable compression on both ends of a serial connection.

Unicast or Multicast RTP Packets

This command can compress unicast or multicast RTP packets; consequently, multicast backbone (MBONE) traffic can also be compressed over slow links. The compression scheme is beneficial only when you have small payload sizes, as in audio traffic.

Examples

The following example enables RTP header compression on the Serial1/0 interface and limits the number of RTP header compression connections to 10. In this example, the **ietf-format** keyword of the **ip rtp header-compression** command is specified.

```
Router> enable
Router# configure terminal
Router(config)# interface t1/0
controller T1 0/4
Router(config-if)# encapsulation ppp
Router(config-if)# ip rtp header-compression ietf-format
Router(config-if)# ip rtp compression-connections 10
Router(config-if)# exit
```

In the following example, RTP header compression is enabled on the Serial1/0 interface and the optional **periodic-refresh** keyword of the **ip rtp header-compression** command is specified:

```
Router> enable
Router# configure terminal
Router(config)# interface Serial1/0
Router(config-if)# encapsulation ppp
Router(config-if)# ip rtp header-compression ietf-format periodic-refresh
Router(config-if)# ip rtp compression-connections 10
Router(config-if)# exit
```

The following example enables IEFT RTP header compression on the multilink1 interface:

```
Router> enable
Router# configure terminal
Router(config)# interface Multilink 1
Router(config-if)# ip rtp header-compression ietf-format
Router(config-if)# shutdown
Router(config-if)# no shutdown
Router(config-if)# exit
```

Related Commands

Command	Description
clear ip rtp header-compression	Clears RTP header compression structures and statistics.
show ip rtp header-compression	Displays RTP header compression statistics.
show platform hardware winpath iphc	Displays the IPHC information for the Winpath hardware device on the Cisco MWR 2941.
show running-config	Displays the contents of the currently running configuration file or the configuration for a specific interface, or map class information.

ip sla responder twamp

Use the **ip sla responder twamp** global configuration command to configure the switch as a Two-Way Active Measurement Protocol (TWAMP) responder. Use the **no** form of this command to disable the IP SLA TWAMP responder.

ip sla responder twamp [**timeout** *seconds*]

no ip sla responder twamp [**timeout** *seconds*]

Syntax Description

timeout *seconds*	(Optional) Specify the number of seconds a TWAMP session can be inactive before the session ends. The range is 1-604800 seconds. The default is 900 seconds.

Defaults

No IP SLA TWAMP responder is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.2(52)SE	This command was introduced.
15.1(1)MR	This command was integrated into Cisco IOS Release 15.1(1)MR.

Usage Guidelines

After entering the **ip sla responder twamp** command, you enter IP SLA TWAMP reflector configuration mode, and these configuration commands are available:

- **default**: sets a command to its defaults.
- **exit**: exits from IP SLA TWAMP reflector configuration mode.
- **no**: negates a command or resets to its defaults.
- **timeout** *seconds*: specifies the maximum time the session can be inactive before the session ends. The range is 1-604800 seconds. The default is 900 seconds.

For the TWAMP server and reflector to function, you must also configure a TWAMP control device, which serves as the client and session sender. These functions are not configured on a Cisco device.

Examples

This example shows how to configure a switch as an IP SLA TWAMP responder:

```
Router(config)# ip sla responder twamp
Router(config-twamp-ref)# timeout inactivity 900
```

Related Commands

Command	Description
ip sla responder	Enables the Cisco IOS IP Service Level Agreements (SLAs) responder for general IP SLAs operations.
ip sla server twamp	Configures the switch as a Two-Way Active Measurement Protocol (TWAMP) server.
show ip sla standards	(Optional) Display the IP SLAs standards configured on the switch.
show ip sla twamp connection {**detail** | **requests**}	(Optional) Displays the current Cisco IOS IP Service Level Agreements (SLAs) Two-Way Active Measurement Protocol (TWAMP) connections

ip sla server twamp

Use the **ip sla server twamp** global configuration command to configure the switch as a Two-Way Active Measurement Protocol (TWAMP) server. Use the **no** form of this command to disable the IP SLA TWAMP server.

ip sla server twamp

no ip sla server twamp

Syntax Description

This command has no arguments or keywords.

Defaults

No IP SLA TWAMP server is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.2(52)SE	This command was introduced.
15.1(1)MR	This command was integrated into Cisco IOS Release 15.1(1)MR.

Usage Guidelines

After entering the **ip sla server twamp** command, you enter IP SLA TWAMP server configuration mode, and these configuration commands are available:

- **default**: sets a command to its defaults.
- **exit**: exits from IP SLA TWAMP server configuration mode.
- **no**: negates a command or resets to its defaults.
- **port** *port-number*: specifies the source port for TWAMP control traffic. Valid port numbers are from 1 to 65535.
- **timer inactivity** *seconds*: specifies the maximum time the session can be inactive before the session ends. The range is 1-6000 seconds. The default is 900 seconds.

For the TWAMP server and reflector to function, you must also configure a TWAMP control device, which serves as the client and session sender. These functions are not configured on a Cisco device.

Examples

This example shows how to configure a switch as an IP SLA TWAMP server:

```
Router(config)# ip sla server twamp
Router(config-twamp-srvr)# port 862
Router(config-twamp-srvr)# timer inactivity 540
```

Related Commands

Command	Description
ip sla responder	Enables the Cisco IOS IP Service Level Agreements (SLAs) responder for general IP SLAs operations.
ip sla responder twamp	Configures the switch as a Two-Way Active Measurement Protocol (TWAMP) responder.
show ip sla standards	(Optional) Displays the IP SLAs standards configured on the switch.
show ip sla twamp connection {**detail** | **requests**}	(Optional) Displays the current Cisco IOS IP Service Level Agreements (SLAs) Two-Way Active Measurement Protocol (TWAMP) connections.

ip tcp header-compression

Note The Cisco MWR 2941 supports UDP header-compression in IEFT format only.

To enable Transmission Control Protocol (TCP) header compression, use the **ip tcp header-compression** command in interface configuration mode. To disable compression, use the **no** form of this command.

ip tcp header-compression [**passive**] [**iphc-format**] [**ietf-format**]

no ip tcp header-compression [**passive**] [**iphc-format**] [**ietf-format]**

Syntax Description

passive	(Optional) Compresses outgoing TCP packets only if incoming TCP packets on the same interface are compressed. If you do not specify the **passive** keyword, all TCP packets are compressed.
iphc-format	(Optional) Indicates that the IP Header Compression (IPHC) format of header compression will be used.
ietf-format	(Optional) Indicates that the Internet Engineering Task Force (IETF) format of header compression will be used.

Defaults

Enabled.

For PPP interfaces, the default format for header compression is the IPHC format.

For High-Level Data Link Control (HDLC) and Frame Relay interfaces, the default format is as described in RFC 1144, *Compressing TCP/IP Headers for Low-Speed Serial Links*.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0	This command was integrated into Cisco IOS Release 12.0. This command was modified to include the iphc-format keyword.
12.3(4)T	This command was integrated into Cisco IOS Release 12.3(4)T. This command was modified to include the ietf-format keyword.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR.

Usage Guidelines

You can compress the headers of your TCP/IP packets in order to reduce the size of your packets. TCP header compression is supported on serial lines using Frame Relay, HDLC, or PPP encapsulation. You must enable compression on both ends of a serial connection. Compressing the TCP header can speed up Telnet connections dramatically.

In general, TCP header compression is advantageous when your traffic consists of many small packets, not for traffic that consists of large packets. Transaction processing (usually using terminals) tends to use small packets and file transfers use large packets. This feature only compresses the TCP header, so it has no effect on User Datagram Protocol (UDP) packets or other headers.

passive Keyword

By default, the **ip tcp header-compression** command compresses outgoing TCP traffic. This command includes an optional **passive** keyword. If you specify the **passive** keyword, outgoing TCP traffic is compressed only if *incoming* TCP traffic on the *same* interface is compressed. If you do not specify the **passive** keyword, *all* TCP traffic is compressed.

For PPP interfaces, the **passive** keyword is ignored. PPP interfaces negotiate the use of header compression, regardless of whether the **passive** keyword is specified. Therefore, on PPP interfaces, the **passive** keyword is replaced by the IPHC format, the default format for PPP interfaces.

iphc-format Keyword

This command includes the **iphc-format** keyword. The **iphc-forma**t keyword indicates the type of header compression that will be used. For PPP and HDLC interfaces, when the **iphc-format** keyword is specified, Real-Time Protocol (RTP) header compression is also enabled. For this reason, the **ip rtp header-compression** command appears in the output of the **show running-config** command. Because both TCP and RTP header compression are enabled, both TCP and UDP packets are compressed.

Note For Frame Relay interfaces, the **iphc-format** keyword is not available.

ietf-format Keyword

This command includes the **ietf-format** keyword. The **ietf-format** keyword indicates the type of header compression that will be used. For HDLC interfaces, the **ietf-format** keyword compresses only TCP packets. For PPP interfaces, when the **ietf-format** keyword is specified, RTP header compression is also enabled. For this reason, the **ip rtp header-compression** command appears in the output of the **show running-config** command. Because both TCP and RTP header compression are enabled, both TCP and UDP packets are compressed.

Note For Frame Relay interfaces, the **ietf-format** keyword is not available.

Examples

The following example sets the first serial interface for header compression with a maximum of 10 cache entries:

```
Router(config)# interface t1 0/1
Router(config-if)# ip tcp header-compression
Router(config-if)# ip tcp compression-connections 10
```

Related Commands

Command	Description
ip tcp compression-connections	Specifies the total number of TCP header compression connections that can exist on an interface.
show ip tcp header-compression	Displays TCP header compression statistics.
show running-config	Displays the contents of the currently running configuration file or the configuration for a specific interface, or map class information.

keepalive

To enable keepalive packets and to specify the number of times that the Cisco IOS software tries to send keepalive packets without a response before bringing down the interface or before bringing the tunnel protocol down for a specific interface, use the **keepalive** command in interface configuration mode.

When the keepalive function is enabled, a **keepalive** packet is sent at the specified time interval to keep the interface active. To turn off keepalive packets entirely, use the **no** form of this command.

keepalive [*period* [*retries*]]

no keepalive [*period* [*retries*]]

Syntax Description

period	(Optional) Integer value in seconds, that represents the time interval between messages sent by the Cisco IOS software to ensure that a network interface is alive. The value must be greater than 0, and the default is 10.
retries	(Optional) Number of times that the device will continue to send keepalive packets without response before bringing the interface down. The integer value is greater than 1 and less than 255. If omitted, the value that was previously set is used; if no value was specified previously, the default value of 5 is used. If this command is used with a tunnel interface, then this variable specifies the number of times that the device will continue to send keepalive packets without response before bringing the tunnel interface protocol down.

Defaults

period: 10 seconds

retries: 5

If you enter the **keepalive** command with no arguments, the defaults for both arguments are used.

If you enter the **keepalive** command and the timeout (*period*) argument, the default number of retries (5) is used.

If you enter the **no keepalive** command, keepalive packets are disabled on the interface.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(8)T	The retries argument was added and made available on tunnel interfaces.
12.2(13)T	The default value for the retries argument was increased to 5.
12.2(14)S	This command was integrated into Cisco IOS release 12.2(14)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Release	Modification
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Keepalive Time Interval

You can configure the keepalive time interval, which is the frequency at which the Cisco IOS software sends messages to itself (Ethernet and Token Ring) or to the other end (serial and tunnel), to ensure that a network interface is alive. The interval is adjustable in 1-second increments, down to a minimum of 1 second. An interface is declared down after three update intervals have passed without receiving a keepalive packet unless the retry value is set higher.

Setting the keepalive timer to a low value is useful for quickly detecting Ethernet interface failures (such as a transceiver cable disconnecting, or cable that is not terminated).

Line Failure

A typical serial line failure involves losing the Carrier Detect (CD) signal. Because this sort of failure is typically noticed within a few milliseconds, adjusting the keepalive timer for quicker routing recovery is generally not useful.

Keepalive Packets with Tunnel Interfaces

GRE keepalive packets may be sent either from both sides of a tunnel or from just one side. If they are sent from both sides, the *period* and *retries* arguments can be different at each side of the link. If you configure keepalives on only one side of the tunnel, the tunnel interface on the sending side might perceive the tunnel interface on the receiving side to be down because the sending interface is not receiving keepalives. From the receiving side of the tunnel, the link appears normal because no keepalives were enabled on the second side of the link.

Dropped Packets

Because keepalive packets are treated as ordinary packets, it is possible that they will be dropped. To reduce the possibility that dropped keepalive packets will cause the tunnel interface to be taken down, increase the number of retries.

Note When adjusting the keepalive timer for a very-low-bandwidth serial interface, large datagrams can delay the smaller keepalive packets long enough to cause the line protocol to go down. You may need to experiment to determine the best values to use for the timeout and the number of retry attempts.

Examples

The following example shows how to set the keepalive interval to 3 seconds:

```
Router(config)# interface ethernet 0
Router(config-if)# keepalive 3
```

The following example shows how to set the keepalive interval to 3 seconds and the retry value to 7:

```
Router(config)# interface tunnel 1
Router(config-if)# keepalive 3 7
```

l2protocol-tunnel

To enable the protocol tunneling on an interface and specify the type of protocol to be tunneled, use the **l2protocol-tunnel** command in interface configuration mode. To disable protocol tunneling, use the **no** form of this command.

l2protocol-tunnel [**cdp** | **stp** | **vtp**]

no l2protocol-tunnel [**cdp** | **stp** | **vtp**]

Syntax Description

cdp	(Optional) Enables Cisco Discovery Protocol (CDP) tunneling.
lldp	(Optional) Enables Link Layer Discovery Protocol (LLDP) tunneling.
stp	(Optional) Enables Spanning Tree Protocol (STP) tunneling.
vtp	(Optional) Enables VLAN Trunking Protocol (VTP) tunneling.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

On all the service provider edge switches, you must enable PortFast BPDU filtering on the 802.1Q tunnel ports by entering these commands:

```
Router(config-if)# spanning-tree bpdufilter enable
Router(config-if)# spanning-tree portfast
```

Note PortFast BPDU filtering is enabled automatically on tunnel ports.

If you do not specify a protocol, all protocols are tunneled.

You can configure protocol tunneling on VLAN and trunk interfaces.

You must enter the **switchport** command once without any keywords to configure the LAN port as a Layer 2 interface before you can enter additional **switchport** commands with keywords. This action is required only if you have not entered the **switchport** command for the interface.

Examples

This example shows how to enable a tunneling protocol on an interface:

```
Router(config-if)# l2protocol-tunnel cdp
Router(config-if)#
```

This example shows how to disable a tunneling protocol on an interface:

```
Router(config-if)# no l2protocol-tunnel

Protocol tunneling disabled on interface fastEthernet 4/1
Router(config-if)#
```

Related Commands

Command	Description
show l2protocol-tunnel	Displays the protocols that are tunneled on an interface or on all interfaces.
switchport	Modifies the switching characteristics of the Layer 2-switched interface.

l2protocol-tunnel drop-threshold

To specify the maximum number of packets that can be processed for the specified protocol on that interface before being dropped, use the **l2protocol-tunnel drop-threshold** command in interface configuration mode. To reset all the threshold values to 0 and disable the drop threshold, use the **no** form of this command.

l2protocol-tunnel drop-threshold [**cdp** | **lldp** | **stp** | **vtp**] *packets*

no l2protocol-tunnel drop-threshold [**cdp** | **lldp** | **stp** | **vtp**]

Syntax Description

cdp	(Optional) Specifies CDP packets.
lldp	(Optional) Specifies LLDP packets.
stp	(Optional) Specifies STP packets.
vtp	(Optional) Specifies VTP packets.
packets	Maximum number of packets; valid values are from 1 to 4096 packets.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

On all the service-provider edge switches, you must enable PortFast BPDU filtering on the 802.1Q tunnel ports by entering these commands:

```
Router(config-if)# spanning-tree bpdufilter enable
Router(config-if)# spanning-tree portfast
```

Note PortFast BPDU filtering is enabled automatically on tunnel ports.

If you do not specify a protocol, the threshold applies to all protocols.

You can configure protocol tunneling on switch ports only. You must enter the **switchport** command once without any keywords to configure the LAN port as a Layer 2 interface before you can enter additional **switchport** commands with keywords. This action is required only if you have not entered the **switchport** command for the interface.

Refer to the "Configuring IEEE 802.1Q Tunneling and Layer 2 Protocol Tunneling" chapter of the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide* for additional information on setting the drop threshold value.

Examples

This example shows how to set the drop threshold:

```
Router(config-if)# switchport
Router(config-if)# l2protocol-tunnel drop-threshold 3000
Router(config-if)#
```

Related Commands

Command	Description
l2protocol-tunnel	Enables the protocol tunneling on an interface and specifies the type of protocol to be tunneled.
l2protocol-tunnel cos	Specifies a CoS value globally on all ingress Layer-2 protocol tunneling ports.
l2protocol-tunnel global drop-threshold	Enables rate limiting at the software level.
l2protocol-tunnel shutdown-threshold	Specifies the maximum number of packets that can be processed for the specified protocol on that interface in 1 second.
show l2protocol-tunnel	Displays the protocols that are tunneled on an interface or on all interfaces.
switchport	Modifies the switching characteristics of the Layer 2-switched interface.

l2protocol-tunnel shutdown-threshold

To specify the maximum number of packets that can be processed for the specified protocol on that interface in 1 second, use the **l2protocol-tunnel shutdown-threshold** command in interface configuration mode. To reset all the threshold values to 0 and disable the shutdown threshold, use the **no** form ofthis command.

l2protocol-tunnel shutdown-threshold [**cdp** | **lldp** | **stp** | **vtp**] *packets*

no l2protocol-tunnel shutdown-threshold [**cdp** | **lldp** | **stp** | **vtp**] *packets*

Syntax Description

cdp	(Optional) Specifies CDP tunneling.
lldp	(Optional) Specifies LLDP tunneling.
stp	(Optional) Specifies STP tunneling.
vtp	(Optional) Specifies VTP tunneling.
packets	Shutdown threshold; valid values are from 1 to 4096.

Defaults

This command has no default settings.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When the number of *packets* is exceeded, the port is put in error-disabled state.

On all the service-provider edge switches, you must enable PortFast BPDU filtering on the 802.1Q tunnel ports by entering these commands:

```
Router(config-if)# spanning-tree bpdufilter enable
Router(config-if)# spanning-tree portfast
```

Note PortFast BPDU filtering is enabled automatically on tunnel ports.

If you do not specify a protocol, the *packets* value applies to all protocols.

You can configure protocol tunneling on switch ports only. You must enter the **switchport** command once without any keywords to configure the LAN port as a Layer 2 interface before you can enter additional **switchport** commands with keywords. This action is required only if you have not entered the **switchport** command for the interface.

Refer to the "Configuring IEEE 802.1Q Tunneling and Layer 2 Protocol Tunneling" chapter of the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide* for additional information on setting the drop threshold value.

Examples

This example shows how to specify the maximum number of CDP packets that can be processed on that interface in 1 second:

```
Router(config-if)# switchport
Router(config-if)# l2protocol-tunnel shutdown-threshold cdp 200
Router(config-if)#
```

Related Commands

Command	Description
l2protocol-tunnel	Enables the protocol tunneling on an interface and specifies the type of protocol to be tunneled.
show l2protocol-tunnel	Displays the protocols that are tunneled on an interface or on all interfaces.
switchport	Modifies the switching characteristics of the Layer 2-switched interface.

level (CFM-AIS-link)

To configure a maintenance level to receive Alarm Indication Signal (AIS) frames transmitted by a link-status change (server maintenance endpoint [SMEP]), use the **level** command in CFM SMEP AIS configuration mode. To remove the maintenance level, use the **no** form of this command.

level *level-id*

no level

Syntax Description

level-id	Integer from 0 to 7 that specifies the maintenance level.

Command Default

A maintenance level is not configured.

Command Modes

CFM SMEP AIS configuration (config-ais-link-cfm)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
15.0(1)XA	This command was integrated into Cisco IOS Release 15.0(1)XA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command allows you to transmit AIS messages to a higher level maintenance association without configuring a maintenance intermediate point (MIP) for the service.

Examples

The following example shows how to configure maintenance level 5 as the level to receive AIS frames transmitted by a link-status change:

```
Router(config)# ethernet cfm ais link-status global
Router(config-ais-link-cfm)# level 5
```

link-protection enable

To globally enable Microwave 1+1 Hot Standby Protocol (HSBY) protocol on the router, use the **link-protection enable** command in global configuration mode. To disable HSBY, use the **no** form of this command.

link-protection enable

no link-protection enable

Syntax Description

This command has no arguments or keywords.

Command Default

None

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

Use this command to configure Microwave 1+1 Hot Standby Protocol (HSBY). For more information about HSBY, see the *Cisco MWR 2941 Mobile Wireless Edge Router Software Configuration Guide, Release 15.0(1)MR*.

Examples

The following example shows how to configure a link protection group.

```
Router# configure terminal
Router(config)# link-protection enable
```

Related Commands

Command	Description
link-protection management vlan	Specifies the management VLAN used for all configured link protection groups,
link-protection group pccm vlan	Specifies the VLAN used for ODU-to-ODU Continuity Check Messages (P-CCMs)

link-protection group

To specify the Microwave 1+1 Hot Standby Protocol (HSBY) link-protection group of which the MEP interface is a member, use the **link-protection group** command in MEP interface configuration mode. To remove a link-protection group configuration, use the **no** form of this command.

link-protection group *group-number*

no link-protection group *group-number*

Syntax Description

group-number	The link-protection group number. Valid values are 1–65535.

Command Default

None

Command Modes

MEP Interface configuration (config-if-ecfm-mep)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

You must define the Ethernet CFM domain and service before configuring a link-protection group.

Use this command to configure Microwave 1+1 Hot Standby Protocol (HSBY). For more information about HSBY, see the *Cisco MWR 2941 Mobile Wireless Edge Router Software Configuration Guide, Release 15.0(1)MR*.

Examples

The following example shows how to configure a link protection group.

```
Router# configure terminal
Router(config)# ethernet cfm domain LPG level 0
Router(config-ecfm)# id null
Router(config-ecfm)# service number 100 vlan 10 direction down
Router(config-ecfm-srv)# continuity-check
Router(config-ecfm-srv)# continuity-check interval 100ms
Router(config-ecfm-srv)# exit
Router(config-ecfm)# exit
Router(config)# interface gigabitEthernet 0/5
Router(config-if)# ethernet cfm mep domain LPG mpid 1 vlan 10
Router(config-if-ecfm-mep)# link-protection group 12
```

Related Commands

Command	Description
link-protection management vlan	Specifies the management VLAN used for all configured link protection groups,
link-protection group pccm vlan	Specifies the VLAN used for ODU-to-ODU Continuity Check Messages (P-CCMs)

link-protection group pccm vlan

To specify the VLAN used for ODU-to-ODU Continuity Check Messages (P-CCMs) for Microwave 1+1 Hot Standby Protocol (HSBY), use the **link-protection group pccm vlan** command in global configuration mode. To remove a P-CCM configuration, use the **no** form of this command.

link-protection group *group-number* **pccm vlan** *vlan-id*

no link-protection group *group-number* **pccm vlan** *vlan-id*

Syntax Description

group-number	The link-protection group number. Valid values are 1–65535.
vlan-id	Specifies the management VLAN number. Valid values are 16–50.

Command Default

The default PCCM VLAN is 16.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

VLANs 1-50 are reserved for IDU-to-ODU Continuity Check Message (E-CCM) and ODU-to-ODU Continuity Check Message (P-CCM) VLANs.

Use this command to configure Microwave 1+1 Hot Standby Protocol (HSBY). For more information about HSBY, see the *Cisco MWR 2941 Mobile Wireless Edge Router Software Configuration Guide, Release 15.0(1)MR*.

Examples

In the following example, VLAN 30 is configured for PCCM traffic.

```
Router# configure terminal
Router(config)# link-protection group 100 pccm vlan 30
```

Related Commands

Command	Description
link-protection group	Specifies the link-protection group of which the MEP interface is a member.

link-protection management vlan

To specify the management VLAN used for all configured link protection groups for Microwave 1+1 Hot Standby Protocol (HSBY), use the **link-protection management vlan** command in global configuration mode. To remove a management VLAN configuration, use the **no** form of this command.

link-protection management vlan *vlan-id*

no link-protection management vlan *vlan-id*

Syntax Description

vlan-id	Specifies the management VLAN number. Valid values are 51–4094.

Command Default

The default management VLAN is 51.

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

Use this command to specify the management VLAN for a link protection group, also referred to as a link protection pair.

VLANs 1-50 are reserved for IDU-to-ODU Continuity Check Message (E-CCM) and ODU-to-ODU Continuity Check Message (P-CCM) VLANs and are not for use as the management VLAN.

Use this command to configure Microwave 1+1 Hot Standby Protocol (HSBY). For more information about HSBY, see the *Cisco MWR 2941 Mobile Wireless Edge Router Software Configuration Guide, Release 15.0(1)MR*.

Examples

The following example show how to configure a link-protection management VLAN.

```
Router# configure terminal
Router(config)# link-protection management vlan 60
Router(config)# exit
Router#
```

Related Commands

Command	Description
link protection group	Specifies the link-protection group of which the MEP interface is a member.

load-interval

To change the length of time for which data is used to compute load statistics, use the **load-interva**l interface configuration command. Use the **no** form of this command to revert to the default setting.

load-interval *seconds*

no load-interval *seconds*

Syntax Description

seconds	Length of time for which data is used to compute load statistics. Specify a value that is a multiple of 30, from 30 to 600 (30, 60, 90, 120, and so forth).

Command Default

The default is 300 seconds (5 minutes).

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.
12.2(4)T	This command was made available in Frame Relay DLCI configuration mode.
12.2(18)SXF	Support for this command was introduced on the Supervisor Engine 720.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If you want load computations to be more reactive to short bursts of traffic, rather than averaged over 5-minute periods, you can shorten the length of time over which load averages are computed.

If the load interval is set to 30 seconds, new data is used for load calculations over a 30-second period. This data is used to compute load statistics, including input rate in bits and packets per second, output rate in bits and packets per second, load, and reliability.

Load data is gathered every 5 seconds. This data is used for a weighted average calculation in which more-recent load data has more weight in the computation than older load data. If the load interval is set to 30 seconds, the average is computed for the last 30 seconds of load data.

The **load-interval** command allows you to change the default interval of 5 minutes to a shorter or longer period of time. if you change it to a shorter period of time, the input and output statistics that are displayed when you use the **show interface** command will be more current, and based on more instantaneous data, rather than reflecting a more average load over a longer period of time.

This command is often used for dial backup purposes, to increase or decrease the likelihood of a backup interface being implemented, but it can be used on any interface.

Examples

In the following example, the default 5-minute average is set to a 30-second average. A burst in traffic that would not trigger a dial backup for an interface configured with the default 5-minute interval might trigger a dial backup for this interface that is set for a shorter, 30-second interval.

```
Router(config)# interface serial 0
Router(config-if)# load-interval 30
```

Related Commands

Command	Description
show interfaces	Displays ALC information.

mac-address-table learning

To enable MAC-address learning, use the **mac-address-table learning** command in global configuration mode. To disable learning, use the **no** form of this command.

[**default**] **mac-address-table learning** {**vlan** *vlan-id [,vlan-id | -vlan-id]* | **interface** *interface slot/port*}

no mac-address-table learning {**vlan** *vlan-id* | **interface** *interface slot/port*}

Syntax Description

default	(Optional) Returns to the default settings.
vlan *vlan-id*	Specifies the VLAN to apply the per-VLAN learning of all MAC addresses; valid values are from 1 to 4094.
interface	Specifies per-interface based learning of all MAC addresses.
interface slot/port	Interface type, the slot number, and the port number. This command applies only to Gigabit Ethernet interfaces.

Command Default

None

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(18)SXE	Support for this command was introduced on the Supervisor Engine 720.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **module** keyword.

Usage Guidelines

You can use the **vlan** *vlan-id* keyword and argument only on switch-port VLANs. You cannot use the **vlan** *vlan-id* keyword and argument to configure learning on routed interfaces.

You can use the **interface** *interface slot/port* keyword and arguments on routed interfaces, supervisor engines, and DFCs only. You cannot use the **interface** *interface slot/port* keyword and arguments to configure learning on switch-port interfaces or non-DFC modules.

You can only apply this command to Gigabit Ethernet interfaces.

Examples

This example shows how to enable MAC-address learning on a VLAN interface:

```
Router(config)# mac-address-table learning vlan 100
Router(config)#
```

This example enables MAC-address learning on multiple VLANs.

```
Router(config)# mac-address-table learning vlan 691,694
Router(config)#
```

This example enables MAC-address learning on a range of VLANs.

```
Router(config)# mac-address-table learning vlan 691-700
Router(config)#
```

This example shows how to disable MAC-address learning for all modules on a specific routed interface:

```
Router(config)# no mac-address-table learning interface GigabitEthernet 0/5
Router(config)#
```

Related Commands

Command	Description
show mac-address-table learning	Displays the MAC-address learning state.

match any

To configure the match criteria for a class map to be successful match criteria for all packets, use the **match any** command in class-map configuration mode. To remove all criteria as successful match criteria, use the **no** form of this command.

match any

no match any

Syntax Description

This command has no arguments or keywords.

Command Default

No match criteria are specified.

Command Modes

Class-map configuration

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.0(5)T	This command was integrated into Cisco IOS Release 12.0(5)T.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB and implemented on the Cisco 10000 series router.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

In the following configuration, all packets leaving Ethernet interface 0/1 will be policed based on the parameters specified in policy-map class configuration mode:

```
Router(config)# class-map matchany
Router(config-cmap)# match any
Router(config-cmap)# exit

Router(config)# policy-map policy1
Router(config-pmap)# class class4
Router(config-pmap-c)# police 8100 1500 2504 conform-action transmit exceed-action
set-qos-transmit 4
Router(config-pmap-c)# exit

Router(config)# interface gigabitethernet0/1
Router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
match input-interface	Configures a class map to use the specified input interface as a match criterion.
match protocol	Configures the match criteria for a class map on the basis of the specified protocol.

match atm clp

To enable packet matching on the basis of the ATM cell loss priority (CLP), use the **match atm clp** command in class-map configuration mode. To disable packet matching on the basis of the ATM CLP, use the **no** form of this command.

match atm clp

no match atm clp

Syntax Description

This command has no arguments or keywords.

Command Default

Packets are not matched on the basis of the ATM CLP.

Command Modes

Class-map configuration (config-cmap)

Command History

Release	Modification
12.0(28)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SRC	Support for the Cisco 7600 series router was added.
12.4(15)T2	This command was integrated into Cisco IOS Release 12.4(15)T2.
12.2(33)SB	Support for the Cisco 7300 series router was added.
Cisco IOS XE Release 2.3	This command was integrated into Cisco IOS XE Release 2.3.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release uses the syntax **match atm clp** instead of **match atm-clp**.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release uses the syntax **match atm clp** instead of **match atm-clp**.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is supported on policy maps that are attached to ATM main interfaces, ATM subinterfaces, or ATM permanent virtual circuits (PVCs). However, policy maps (containing the **match atm clp** command) that are attached to these types of ATM interfaces can be *input* policy maps *only*.

This command is supported on the PA-A3 adapter *only*.

Examples

In the following example, a class called "class-c1" has been created using the **class-map** command, and the **match atm clp** command has been configured inside that class. Therefore, packets are matched on the basis of the ATM CLP and are placed into this class.

```
Router> enable
Router# configure terminal
Router(config)# class-map class-c1
Router(config-cmap)# match atm clp
Router(config-cmap)# end
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
show atm pvc	Displays all ATM PVCs and traffic information.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.

match cos

To match a packet on the basis of a Layer 2 class of service (CoS)/Inter-Switch Link (ISL) marking, use the **match cos** command in class-map configuration mode. To remove a specific Layer 2 CoS/ISL marking as a match criterion, use the **no** form of this command.

match cos *cos-value* [*cos-value* [*cos-value* [*cos-value*]]]

no match cos *cos-value* [*cos-value* [*cos-value* [*cos-value*]]]

Syntax Description

cos-value	Specific IEEE 802.1Q/ISL CoS value. The *cos-value* is from 0 to 7; up to four CoS values, separated by a space, can be specified in one **match cos** statement.

Command Default

Packets are not matched on the basis of a Layer 2 CoS/ISL marking.

Command Modes

Class-map configuration (config-cmap)

Command History

Release	Modification
12.1(5)T	This command was introduced.
12.0(25)S	This command was integrated into Cisco IOS Release 12.0(25)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	This command was implemented on the Cisco 10000 series router.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(33)SRC	Support for the Cisco 7600 series router was added.
12.4(15)T2	This command was integrated into Cisco IOS Release 12.4(15)T2.
12.2(33)SB	Support for the Cisco 7300 series router was added.
12.4(20)MR	This command was incorporated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

In the following example, the CoS values of 1, 2, and 3 are successful match criteria for the interface that contains the classification policy called cos:

```
Router(config)# class-map cos
Router(config-cmap)# match cos 1 2 3
```

In the following example, classes called voice and video-n-data are created to classify traffic based on the CoS values. QoS treatment is then given to the appropriate packets in the CoS-based-treatment policy map (in this case, the QoS treatment is priority 64 and bandwidth 512). The service policy configured in this example is attached to all packets leaving Fast Ethernet interface 0/0.1. The service policy can be attached to any interface that supports service policies.

```
Router(config)# class-map voice
Router(config-cmap)# match cos 7

Router(config)# class-map video-n-data
Router(config-cmap)# match cos 5

Router(config)# policy-map cos-based-treatment
Router(config-pmap)# class voice
Router(config-pmap-c)# priority 64
Router(config-pmap-c)# exit
Router(config-pmap)# class video-n-data
Router(config-pmap-c)# bandwidth 512
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# interface fastethernet0/0.1
Router(config-if)# service-policy output cos-based-treatment
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set cos	Sets the Layer 2 CoS value of an outgoing packet.
show class-map	Displays all class maps and their matching criteria.

match dscp

To identify one or more differentiated service code point (DSCP), Assured Forwarding (AF), and Certificate Server (CS) values as a match criterion, use the **match dscp** command in class-map configuration mode. To remove a specific DSCP value from a class map, use the **no** form of this command.

match [**ip**] **dscp** *dscp-value* [*dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value dscp-value*]

no match [**ip**] **dscp** *dscp-value*

Syntax Description

ip	(Optional) Specifies that the match is for IPv4 packets only. If not used, the match is on both IPv4 and IPv6 packets.
dscp-value	The DSCP value used to identify a DSCP value. For valid values, see the "Usage Guidelines."

Command Default

No match criteria is configured.

If you do not enter the **ip** keyword, matching occurs on both IPv4 and IPv6 packets.

Command Modes

Class-map configuration

Command History

Release	Modification
12.2(13)T	This command was introduced. This command replaces the **match ip dscp** command.
12.0(28)S	Support for this command in IPv6 was added in Cisco IOS Release S12.0(28)S on the
12.0(17)SL	This command was implemented on the Cisco 10000 series router.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

DSCP Values

You must enter one or more differentiated service code point (DSCP) values. The command may include any combination of the following:

- numbers (0 to 63) representing differentiated services code point values
- af numbers (for example, af11) identifying specific AF DSCPs
- cs numbers (for example, cs1) identifying specific CS DSCPs
- **default**—Matches packets with the default DSCP.
- **ef**—Matches packets with EF DSCP.

For example, if you wanted the DCSP values of 0, 1, 2, 3, 4, 5, 6, or 7 (note that only one of the IP DSCP values must be a successful match criterion, not all of the specified DSCP values), enter the **match dscp 0 1 2 3 4 5 6 7** command.

This command is used by the class map to identify a specific DSCP value marking on a packet. In this context, *dscp-value* arguments are used as markings only and have no mathematical significance. For instance, the *dscp-value* of 2 is not greater than 1. The value simply indicates that a packet marked with the *dscp-value* of 2 is different than a packet marked with the *dscp-value* of 1. The treatment of these marked packets is defined by the user through the setting of Quality of Service (QoS) policies in policy-map class configuration mode.

Match Packets on DSCP Values

To match DSCP values for IPv6 packets only, the **match protocol ipv6** command must also be used. Without that command, the DSCP match defaults to match both IPv4 and IPv6 packets.

To match DSCP values for IPv4 packets only, use the **ip** keyword. Without the **ip** keyword the match occurs on both IPv4 and IPv6 packets. Alternatively, the **match protocol ip** command may be used with **match dscp** to classify only IPv4 packets.

After the DSCP bit is set, other QoS features can then operate on the bit settings.

The network can give priority (or some type of expedited handling) to marked traffic. Typically, you set the precedence value at the edge of the network (or administrative domain); data is then queued according to the precedence. Weighted fair queueing (WFQ) can speed up handling for high-precedence traffic at congestion points.

Examples

The following example shows how to set multiple match criteria. In this case, two IP DSCP value and one AF value.

```
Router(config)# class-map map1
Router(config-cmap)# match dscp 1 2 af11
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
match protocol ip	Matches DSCP values for packets.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set dscp	Marks the DSCP value for packets within a traffic class.
show class-map	Displays all class maps and their matching criteria.

match ip dscp

To identify a specific IP differentiated service code point (DSCP) value as a match criterion, use the **match ip dscp** class-map configuration command. To remove a specific IP DSCP value from a class map, use the **no** form of this command.

match ip dscp *ip-dscp-value* [*ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value*]

no match ip dscp *ip-dscp-value* [*ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value ip-dscp-value*]

Syntax Description

ip-dscp-value	Specifies the exact value from 0 to 63 used to identify an IP DSCP value.

Command Modes

Class-map configuration

Command History

Release	Modification
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Up to eight IP DSCP values can be matched in one match statement. For example, if you wanted the IP DSCP values of 0, 1, 2, 3, 4, 5, 6, or 7 (note that only one of the IP DSCP values must be a successful match criterion, not all of the specified IP DSCP values), enter the **match ip dscp 0 1 2 3 4 5 6 7** command.

This command is used by the class map to identify a specific IP DSCP value marking on a packet. The *ip-dscp-value* arguments are used as markings only. The IP DSCP values have no mathematical significance. For instance, the *ip-dscp-value* of 2 is not greater than 1. The value simply indicates that a packet marked with an *ip-dscp-value* of 2 is different from a packet marked with an *ip-dscp-value* of 1. The treatment of these marked packets is defined by the user through the setting of QoS policies in policy-map class configuration mode.

Examples

The following example shows how to configure the service policy called priority55 and attach service policy priority55 to an interface. In this example, the class map called ipdscp15 evaluates all packets entering interface Fast Ethernet 0/0 for an IP DSCP value of 15. If the incoming packet has been marked with the IP DSCP value of 15, the packet is treated with a priority level of 55.

```
Router(config)# class-map ipdscp15
Router(config-cmap)# match ip dscp 15
Router(config-cmap)# exit
Router(config)# policy-map priority55
Router(config-pmap)# class ipdscp15
Router(config-pmap-c)# priority55
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface fa0/0
Router(config-if)# service-policy input priority55
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set ip dscp	Marks the IP DSCP value for packets within a traffic class.
show class-map	Displays all class maps and their matching criteria.

match mpls experimental

To configure a class map to use the specified value or values of the experimental (EXP) field as a match criteria, use the **match mpls experimental** command in class-map configuration mode. To remove the EXP field match criteria from a class map, use the **no** form of this command.

match mpls experimental *number*

no match mpls experimental *number*

Syntax Description

number	EXP field value (any number from 0 through 7) to be used as a match criterion. You can specify multiple values, separated by a space (for example, 3 4 7).

Command Default

No match criteria are specified.

Command Modes

Class-map configuration

Command History

Release	Modification
12.0(7)XE1	This command was introduced.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2(4)T	This command was implemented on the Cisco MGX 8850 switch and the MGX 8950 switch with a Cisco MGX RPM-PR card.
12.2(4)T2	This command was implemented on the Cisco 7500 series.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB and implemented on the Cisco 10000 series.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

For class-based weighted fair queueing (CBWFQ), you define traffic classes based on match criteria such as input interfaces, access control lists (ACLs), protocols, quality of service (QoS) labels, and experimental (EXP) field values. Packets satisfying the match criteria for a class constitute the traffic for that class.

The **match mpls experimental** command specifies the name of an EXP field value to be used as the match criterion against which packets are compared to determine if they belong to the class specified by the class map.

To use the **match mpls experimental** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish. After you identify the class, you can use one of the following commands to configure its match criteria:

- **match access-group**
- **match input-interface**
- **match mpls experimental**
- **match protocol**

If you specify more than one command in a class map, only the last command entered applies. The last command overrides the previously entered commands.

For CBWFQ, you define traffic classes based on match criteria such as input interfaces, ACLs, protocols, QoS labels, and EXP field values. Packets satisfying the match criteria for a class constitute the traffic for that class.

To use the **match mpls experimental** command, you must first enter the **class-map** command to specify the name of the class whose match criteria you want to establish.

Examples

The following example specifies a class map called ethernet1 and configures the Multiprotocol Label Switching (MPLS) experimental values of 1 and 2 to be used as the match criteria for this class:

```
Router(config)# class-map ethernet1
Router(config-cmap)# match mpls experimental 1 2
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
match access-group	Configures the match criteria for a class map based on the specified ACL.
match input-interface	Configures a class map to use the specified input interface as a match criterion.
match mpls experimental topmost	Matches the EXP value in the topmost label.
match protocol	Matches traffic by a particular protocol.
match qos-group	Configures the match criteria for a class map based on the specified protocol.

match precedence

To identify IP precedence values to use as the match criterion, use the **match precedence** command in class-map configuration mode. To remove IP precedence values from a class map, use the **no** form of this command.

match [**ip**] **precedence** {*precedence-criteria1* | *precedence-criteria2* | *precedence-criteria3* | *precedence-criteria4}*

no match [**ip**] **precedence** {*precedence-criteria1* | *precedence-criteria2* | *precedence-criteria3* | *precedence-criteria4}*

Syntax Description

ip	(Optional) Specifies that the match is for IPv4 packets only. If not used, the match is on both IP and IPv6 packets.
precedence-criteria1 *precedence-criteria2* *precedence-criteria3* *precedence-criteria4*	Identifies the precedence value. You can enter up to four different values, separated by a space. See the "Usage Guidelines" for valid values.

Command Default

No match criterion is configured.

If you do not enter the **ip** keyword, matching occurs on both IPv4 and IPv6 packets.

Command Modes

Class-map configuration mode (config-cmap)

Command History

Release	Modification
12.2(13)T	This command was introduced. This command replaces the **match ip precedence** command.
12.0(17)SL	This command was implemented on the Cisco 10000 series router.
12.0(28)S	Support for this command in IPv6 was added on the Cisco 12000 series Internet router.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You can enter up to four matching criteria, as number abbreviation (0 to 7) or criteria names (critical, flash, and so on), in a single match statement. For example, if you wanted the precedence values of 0, 1, 2, or 3 (note that only one of the precedence values must be a successful match criterion, not all of the specified precedence values), enter the **match ip precedence 0 1 2 3** command. The *precedence-criteria*

numbers are not mathematically significant; that is, the *precedence-criteria* of 2 is not greater than 1. The way that these different packets are treated depends upon quality of service (QoS) policies, set in the policy-map configuration mode.

You can configure a QoS policy to include IP precedence marking for packets entering the network. Devices within your network can then use the newly marked IP precedence values to determine how to treat the packets. For example, you can mark voice packets with a particular precedence. You can then configure low-latency queueing (LLQ) to place all packets of that precedence into the priority queue.

Precedence Values and Names

The following table lists all criteria conditions by value, name, binary value, and recommended use. You may enter up to four criteria, each separated by a space. Only one of the precedence values must be a successful match criterion. Table 1-4 lists the IP precedence values.

Table 1-4 IP Precedence Values

Precedence Value	Precedence Name	Binary Value	Recommended Use
0	routine	000	Default marking value
1	priority	001	Data applications
2	immediate	010	Data applications
3	flash	011	Call signaling
4	flash-override	100	Video conferencing and streaming video
5	critical	101	Voice
6	internet (control)	110	Network control traffic (such as routing, which is typically precedence 6)
7	network (control)	111	

Do not use IP precedence 6 or 7 to mark packets, unless you are marking control packets.

Examples

IPv4-Specific Traffic Match

The following example shows how to configure the service policy called “priority50” and attach service policy “priority50” to an interface, matching for IPv4 traffic only. In a network where both IPv4 and IPv6 are running, you might find it necessary to distinguish between the protocols for matching and traffic segregation. In this example, the class map called “ipprec5” will evaluate all IPv4 packets entering Fast Ethernet interface 1/0/0 for a precedence value of 5. If the incoming IPv4 packet has been marked with the precedence value of 5, the packet will be treated as priority traffic and will be allocated with bandwidth of 50 kbps.

```
Router(config)# class-map ipprec5
Router(config-cmap)# match ip precedence 5
Router(config)# exit
Router(config)# policy-map priority50
Router(config-pmap)# class ipprec5
Router(config-pmap-c)# priority 50
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface fa1/0/0
Router(config-if)# service-policy input priority50
```

IPv6-Specific Traffic Match

The following example shows the same service policy matching on precedence for IPv6 traffic only. Notice that the **match protocol** command with the **ipv6** keyword precedes the **match precedence** command. The **match protocol** command is required to perform matches on IPv6 traffic alone.

```
Router(config)# class-map ipprec5
Router(config-cmap)# match protocol ipv6
Router(config-cmap)# match precedence 5
Router(config)# exit
Router(config)# policy-map priority50
Router(config-pmap)# class ipprec5
Router(config-pmap-c)# priority 50
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface fa1/0/0
Router(config-if)# service-policy input priority50
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
match protocol	Configures the match criteria for a class map on the basis of a specified protocol.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set ip precedence	Sets the precedence value in the IP header.
show class-map	Displays all class maps and their matching criteria, or a specified class map and its matching criteria.

match qos-group

To identify a specific quality of service (QoS) group value as a match criterion, use the **match qos-group** command in class-map configuration mode. To remove a specific QoS group value from a class map, use the **no** form of this command.

match qos-group *qos-group-value*

no match qos-group *qos-group-value*

Syntax Description

qos-group-value	The exact value from 0 to 99 used to identify a QoS group value.

Command Default

No match criterion is specified.

Command Modes

Class-map configuration (config-cmap)

Command History

Release	Modification
11.1CC	This command was introduced.
12.05(XE)	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB and implemented on the Cisco 10000 series.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **match qos-group** command is used by the class map to identify a specific QoS group value marking on a packet. This command can also be used to convey the received Multiprotocol Label Switching (MPLS) experimental (EXP) field value to the output interface.

The *qos-group-value* argument is used as a marking only. The QoS group values have no mathematical significance. For instance, the *qos-group-value* of 2 is not greater than 1. The value simply indicates that a packet marked with the *qos-group-value* of 2 is different than a packet marked with the *qos-group-value* of 1. The treatment of these packets is defined by the user through the setting of QoS policies in QoS policy-map class configuration mode.

The QoS group value is local to the router, meaning that the QoS group value that is marked on a packet does not leave the router when the packet leaves the router. If you need a marking that resides in the packet, use IP precedence setting, IP differentiated services code point (DSCP) setting, or another method of packet marking.

Examples

The following example shows how to configure the service policy called "priority50" and attach service policy "priority50" to an interface. In this example, the class map called "qosgroup5" will evaluate all packets entering GigabitEthernet interface 1/0/0 for a QoS group value of 5. If the incoming packet has been marked with the QoS group value of 5, the packet will be treated with a priority level of 50.

```
Router(config)# class-map qosgroup5
Router(config-cmap)# match qos-group 5
Router(config)# exit
Router(config)# policy-map priority50
Router(config-pmap)# class qosgroup5
Router(config-pmap-c)# priority 50
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface gigabitethernet1/0/0
Router(config-if)# service-policy output priority50
```

Related Commands

Command	Description
class-map	Creates a class map to be used for matching packets to a specified class.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set precedence	Specifies an IP precedence value for packets within a traffic class.
set qos-group	Sets a group ID that can be used later to classify packets.

match vlan (QoS)

To match and classify traffic on the basis of the virtual local-area network (VLAN) identification number, use the **match vlan** command in class-map configuration mode. To remove a previously specified VLAN identification number as a match criterion, use the **no** form of this command.

match vlan *vlan-id-number*

no match vlan *vlan-id-number*

Syntax Description

vlan-id-number	VLAN identification number, numbers, or range of numbers. Valid VLAN identification numbers must be in the range of 1 to 4095.

Command Default

Traffic is not matched on the basis of the VLAN identification number.

Command Modes

Class-map configuration

Command History

Release	Modification
12.2(31)SB2	This command was introduced for use on Cisco 10000 series routers only.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Specifying VLAN Identification Numbers

You can specify a single VLAN identification number, multiple VLAN identification numbers separated by spaces (for example, 2 5 7), or a range of VLAN identification numbers separated by a hyphen (for example, 25-35).

Support Restrictions

The following restrictions apply to the **match vlan** command:

- The **match vlan** command is supported for IEEE 802.1q and Inter-Switch Link (ISL) VLAN encapsulations only.

Examples

In the following sample configuration, the **match vlan** command is enabled to classify and match traffic on the basis of a range of VLAN identification numbers. Packets with VLAN identification numbers in the range of 25 to 50 are placed in the class called class1.

```
Router> enable
Router# configure terminal
Router(config)# class-map class1
Router(config-cmap)# match vlan 25-50
Router(config-cmap)# end
```

Note Typically, the next step would be to configure class1 in a policy map, enable a quality of service (QoS) feature (for example, class-based weighted fair queueing [CBWFQ]) in the policy map, and attach the policy map to an interface. To configure a policy map, use the **policy-map** command. To enable CBWFQ, use the **bandwidth** command (or use the command for the QoS feature that you want to enable). To attach the policy map to an interface, use the **service-policy** command. For more information about classifying network traffic on the basis of a match criterion, see the "Classification" section of the *Quality of Service Solutions Configuration Guide, Cisco IOS Release 15.0S*.

Related Commands

Command	Description
bandwidth (policy-map class)	Specify or modifies the bandwidth allocated for a class belonging to a policy map.
class-map	Creates a class map to be used for matching packets to a specified class.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces.
service-policy	Attached a policy map to an interface.

maximum meps

To specify the number of maintenance endpoints (MEPs) across the network in a maintenance association, use the **maximum meps** command in Ethernet CFM service configuration mode. To restore the default value, use the **no** form of this command.

maximum meps *max-num*

no maximum meps

Syntax Description

max-num	Integer from 1 to 65535. The default is 100.

Command Default

A maximum number of MEPs is not configured.

Command Modes

Ethernet CFM service configuration (config-ecfm-srv)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When the configured maximum is reached, continuity check messages (CCMs) from other remote MEPs are ignored and a warning message is displayed.

Output of the **show running all** command displays “maximum meps 100” when the default value is configured.

Examples

The following example shows how to configure a maximum of 50 MEPs:

```
Router(config)# ethernet cfm domain operatorA level 5
Router(config-ether-cfm)# service vlan-id 5 port
Router(config-ether-cfm)# maximum meps 50
```

Related Commands

Command	Description
show running all	Shows the running configuration with default values.

mep archive hold-time

To set the amount of time, in minutes, that data from a missing maintenance end point (MEP) is kept in the continuity check database or that entries are held in the error database before they are purged, use the **mep archive-hold-time** command in Ethernet connectivity fault management (CFM) configuration mode. To restore the default number of minutes, use the **no** form of this command.

mep archive-hold-time *minutes*

no mep archive-hold-time *minutes*

Syntax Description

minutes	Integer from 1 to 65535 that specifies the number of minutes that data from a missing MEP is kept before it is purged. The default is 100.

Command Default

The command is enabled, and the archive hold time is set to 100 minutes.

Command Modes

CFM IEEE 802.1ag Standard (CFM IEEE)

Ethernet CFM configuration (config-ether-cfm)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2. • In this release the command is supported only in CFM IEEE.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the Cisco pre-standard CFM Draft 1 (CFM D1).

Usage Guidelines

When you reset the archive hold time, the new hold time applies only to entries in the database that occur after the reset. Entries made before the hold time was reset are not affected by the change.

Different archive hold times can be set for MEPs in different domains.

Note A missing MEP is a remote MEP that sends a 0 expiration time in its continuity check or a remote MEP whose entry in the local continuity check database expires after it exceeds its lifetime.

In CFM IEEE, output of the **show running all** command displays “mep archive hold-time 100” when the default value is configured.

Examples

The following example shows how to set a timeout period of 1000 minutes in CFM D1:

```
Router(config-ether-cfm)# mep archive-hold-time 1000
```

The following example shows how to set a timeout period of 1000 minutes in CFM IEEE:

```
Router(config-ether-cfm)# mep archive-hold-time 1000
```

Related Commands

Command	Description
show running all	Shows the running configuration with default values.

mep crosscheck mpid vlan

To statically define a remote maintenance endpoint (MEP) within a maintenance domain, use the **mep crosscheck mpid vlan** command in Ethernet CFM configuration mode. To delete a remote MEP, use the **no** form of this command.

mep crosscheck mpid *id* **vlan** *vlan-id* [**mac** *mac-address*]

no mep crosscheck mpid *id* **vlan** *vlan-id* [**mac** *mac-address*]

Syntax Description

id	Integer in the range of 0 to 8191 that forms the maintenance point ID (MPID).
vlan-id	Integer in the range of 1 to 4094 that identifies the VLAN.
mac	(Optional) Indicates that the MAC address of the MEP is specified.
mac-address	(Optional) MAC address in the format abcd.abcd.abcd.

Command Default

No remote MEPs are configured.

Command Modes

Ethernet CFM configuration (config-ether-cfm)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **mep crosscheck mpid vlan** command to statically configure remote MEPs that are part of a domain. These remote MEPs can be used in the cross-check operation. The cross-check operation only works when local MEPs are configured that correspond to the statically configured remote MEPs.

Examples

The following example shows how to define a MEP within a maintenance domain with an ID of 20, in VLAN 5, and with MAC address a5a1.a5a1.a5a1:

```
Router(config-ether-cfm)# mep crosscheck mpid 20 vlan 5 mac a5a1.a5a1.a5a1
```

Related Commands

Command	Description
ethernet cfm domain	Defines a CFM maintenance domain at a particular maintenance level.
ethernet cfm mep crosscheck	Enables cross-checking between the list of configured remote MEPs of a domain and MEPs learned through CCMs.
ethernet cfm mep crosscheck start-delay	Configures the maximum amount of time that a device waits for remote MEPs to come up before the cross-check operation is started.
show ethernet cfm maintenance points remote crosscheck	Displays information about remote maintenance points configured statically in a cross-check list.

mep mpid

To statically define the maintenance endpoints (MEPs) within a maintenance association, use the **mep mpid** command in Ethernet connectivity fault management (CFM) service configuration mode. To remove MEP definitions, use the **no** form of this command.

mep mpid *mpid*

no mep mpid

Syntax Description

mpid	Integer from 1 to 8191 that identifies the MEP.

Command Default

No MEPs are statically defined.

Command Modes

Ethernet CFM service configuration (config-ecfm-srv)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to manually configure a list of MEPs in a maintenance association. The device logs a warning when a discovered MPID is not on the list of configured MPIDs.

Examples

The following example shows how to configure a MEP with an ID of 25:

```
Router(config)# ethernet cfm domain operatorA level 5
Router(config-ecfm)# service vlan-id 5 port
Router(config-ecfm-srv)# mep mpid 25
```

mip auto-create

To enable the automatic creation of a maintenance intermediate point (MIP) at a maintenance domain level, use the **mip auto-create** command in Ethernet connectivity fault management (CFM) configuration mode. To disable the automatic creation of a MIP, use the **no** form of this command.

mip auto-create [**lower-mep-only**]

no mip auto-create [**lower-mep-only**]

Syntax Description

lower-mep-only	(Optional) Creates a MIP only if there is a MEP for the service in another domain at the next lower active maintenance domain level.

Command Default

MIPs will not be created.

Command Modes

Ethernet CFM configuration (config-ecfm)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command configures the MIP creation policy for members of a maintenance domain to apply for automatically creating a MIP at the domain maintenance level.

If you manually configure a MIP for the maintenance association, it will override the **mip auto-create** command for the MIP for that maintenance association. The **mip auto-create** command also has lower precedence than the MIP creation policy at the maintenance association.

Examples

The following example shows how to enable the automatic creation of a MIP in the customerA domain at maintenance level 5:

```
Router# configure terminal
Router(config)# ethernet cfm domain customerA level 5
Router(config-ecfm)# mip auto-create
Router(config-ecfm)# end
Router#
```

mode (ATM/T1/E1 controller)

To set the DSL controller into ATM mode and create an ATM interface or to set the T1 or E1 controller into T1 or E1 mode and create a logical T1/E1 controller, use the **mode** command in controller configuration mode. To disable the current mode and prepare to change modes, use the **no** form of this command.

mode {**atm** | **cas**}

no mode {**atm** | **cas**}

Syntax Description

atm	Sets the controller into ATM mode and creates an ATM interface (ATM 0). When ATM mode is enabled, no channel groups, DS0 groups, PRI groups, or time-division multiplexing (TDM) groups are allowed, because ATM occupies all the DS0s on the T1/E1 trunk. When you set the controller to ATM mode, the controller framing is automatically set to extended super frame (ESF) for T1 or cyclic redundancy check type 4 (CRC4) for E1. The line code is automatically set to binary 8-zero substitution (B8ZS) for T1 or high-density bipolar C (HDBC) for E1. When you remove ATM mode by entering the **no mode atm** command, ATM interface 0 is deleted. **Note** The **mode atm** command without the **aim** keyword uses software to perform ATM segmentation and reassembly (SAR). This is supported on Cisco 2600 series WIC slots only; it is not supported on network module slots.
cas	(Cisco 2600 series WIC slots only) Channel-associated signaling (CAS) mode. The T1 or E1 in this WIC slot is mapped to support T1 or E1 voice (that is, it is configured in a DS0 group or a PRI group). CAS mode is supported on both controller 0 and controller 1. On the Cisco IAD2430 series IAD, CAS mode is not supported.

Defaults

The controller mode is disabled.

Command Modes

Controller configuration

Command History

Release	Modification
11.3 MA	This command was introduced on the Cisco MC3810.
12.1(5)XM	Support for this command was extended to the merged SGCP/MGCP software.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T for the Cisco IAD2420.

Release	Modification
12.2(2)XB	Support was extended to the Cisco 2600 series and Cisco 3660. The keyword **aim** and the argument *aim-slot* were added. The parenthetical modifier for the command was changed from "Voice over ATM" to "T1/E1 controller."
12.2(15)T	This command was implemented on the Cisco 2691 and the Cisco 3700 series.
12.3(4)XD	This command was integrated into Cisco IOS Release 12.3(4)XD on Cisco 2600 series and Cisco 3700 series routers to configure DSL Frame mode and to add T1/E1 Framed support.
12.3(4)XG	This command was integrated into Cisco IOS Release 12.3(4)XG on the Cisco 1700 series routers.
12.3(7)T	This command was integrated into Cisco IOS Release 12.3(7)T on Cisco 2600 series and Cisco 3700 series routers.
12.3(11)T	This command was implemented on Cisco 2800 and Cisco 3800 series routers.
12.3(14)T	This command was implemented on Cisco 1800 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When a DSL controller is configured in ATM mode, the mode must be configured identically on both the CO and CPE sides. Both sides must be set to ATM mode.

Note If using the **no mode atm** command to leave ATM mode, the router must be rebooted immediately to clear the mode.

When configuring a DSL controller in T1 or E1 mode, the mode must be configured identically on the CPE and CO sides.

Examples

ATM Mode Example

The following example configures ATM mode on the DSL controller.

```
Router(config)# controller dsl 3/0
Router(config-controller)# mode atm
```

CAS Mode Example

The following example configures T1 mode on the DSL controller.

```
Router(config)# controller t1 3/0
Router(config-controller)# mode cas
```

Related Commands

Command	Description
channel-group	Configures a list of time slots for voice channels on controller T1 0 or E1 0.
tdm-group	Configures a list of time slots for creating clear channel groups (pass-through) for time-division multiplexing (TDM) cross-connect.

mpls ip (global configuration)

To enable Muliprotocol Label Switching (MPLS) forwarding of IPv4 packets along normally routed paths for the platform, use the **mpls ip** command in global configuration mode. To disable this feature, use the **no** form of this command.

mpls ip

no mpls ip

Syntax Description

This command has no arguments or keywords.

Defaults

Label switching of IPv4 packets along normally routed paths is enabled for the platform.

Command Modes

Global configuration

Command History

Release	Modification
12.0(10)ST	This command was introduced.
12.0(14)ST	This command was integrated into Cisco IOS Release 12.0(14)ST.
12.1(2)T	This command was integrated into Cisco IOS Release 12.1(2)T.
12.1(8a)E	This command was integrated into Cisco IOS Release 12.1(8a)E.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.2(4)T	This command was integrated into Cisco IOS Release 12.2(4)T.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.0(21)ST	This command was integrated into Cisco IOS Release 12.0(21)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.0(23)S	This command was integrated into Cisco IOS Release 12.0(23)S.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000-PRE2 router.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

MPLS forwarding of IPv4 packets along normally routed paths (sometimes called dynamic label switching) is enabled by this command. For a given interface to perform dynamic label switching, this switching function must be enabled for the interface and for the platform.

The **no** form of this command stops dynamic label switching for all platform interfaces regardless of the interface configuration; it also stops distribution of labels for dynamic label switching. However, the **no** form of this command does not affect the sending of labeled packets through label switch path (LSP) tunnels.

For an LC-ATM interface, the **no** form of this command prevents the establishment of label virtual circuits (LVCs) originating at, terminating at, or passing through the platform.

Examples

The following example shows that dynamic label switching is disabled for the platform, and all label distribution is terminated for the platform:

```
Router(config)# no mpls ip
```

Related Commands

Command	Description
mpls ip (interface configuration)	Enables MPLS forwarding of IPv4 packets along normally routed paths for the associated interface.

mpls ip (interface configuration)

To enable Multiprotocol Label Switching (MPLS) forwarding of IPv4 packets along normally routed paths for a particular interface, use the **mpls ip** command in interface configuration mode. To disable this feature, use the **no** form of this command.

mpls ip

no mpls ip

Syntax Description

This command has no arguments or keywords.

Defaults

MPLS forwarding of IPv4 packets along normally routed paths for the interface is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(10)ST	This command was introduced.
12.0(14)ST	This command was integrated into Cisco IOS Release 12.0(14)ST.
12.1(2)T	This command was integrated into Cisco IOS Release 12.1(2)T.
12.1(8a)E	This command was integrated into Cisco IOS Release 12.1(8a)E.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.2(4)T	This command was integrated into Cisco IOS Release 12.2(4)T.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.0(21)ST	This command was integrated into Cisco IOS Release 12.0(21)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.0(23)S	This command was integrated into Cisco IOS Release 12.0(23)S.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000-PRE2 router.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

MPLS forwarding of IPv4 packets along normally routed paths is sometimes called dynamic label switching. If dynamic label switching has been enabled for the platform when this command is issued on an interface, label distribution for the interface begins with the periodic transmission of neighbor discovery Hello messages on the interface. When the outgoing label for a destination routed through the interface is known, packets for the destination are labeled with that outgoing label and forwarded through the interface.

The **no** form of this command causes packets routed out through the interface to be sent unlabeled; this form of the command also terminates label distribution for the interface. However, the **no** form of the command does not affect the sending of labeled packets through any link-state packet (LSP) tunnels that might use the interface.

For an LC-ATM interface, the **no** form of this command prevents the establishment of label virtual circuits (LVCs) beginning at, terminating at, or passing through the interface.

Examples

The following example shows that label switching is enabled on the specified Ethernet interface:

```
Router(config)# configure terminal
Router(config-if)# interface e0/2
Router(config-if)# mpls ip
```

Related Commands

Command	Description
mpls ldp maxhops	Limits the number of hops permitted in an LSP established by the Downstream on Demand method of label distribution.
show mpls interfaces	Displays information about one or more interfaces that have been configured for label switching.

mpls ldp router-id

To specify a preferred interface for the Label Distribution Protocol (LDP) router ID, use the **mpls ldp router-id** command in global configuration mode. To disable the interface from being used as the LDP router ID, use the **no** form of this command.

mpls ldp router-id [**vrf** *vrf-name*] *interface* [**force**]

no mpls ldp router-id [**vrf** *vrf-name*] [*interface* [**force**]]

Syntax Description

vrf *vrf-name*	(Optional) Selects the interface as the LDP router ID for the named Virtual Private Network (VPN) routing and forwarding (VRF) table. The selected interface must be associated with the named VRF.
interface	The specified interface to be used as the LDP router ID, provided that the interface is operational.
force	(Optional) Alters the behavior of the **mpls ldp router-id** command, as described in theUsage Guidelines "Usage Guidelines" section.

Command Default

If the **mpls ldp router-id** command is not executed, the router determines the LDP router ID as follows:

1. The router examines the IP addresses of all operational interfaces.
2. If these IP addresses include loopback interface addresses, the router selects the largest loopback address as the LDP router ID.
3. Otherwise, the router selects the largest IP address pertaining to an operational interface as the LDP router ID.

Command Modes

Global configuration

Command History

Release	Modification
12.0(10)ST	This command was introduced.
12.0(14)ST	The **force** keyword was added.
12.1(2)T	This command was integrated into Cisco IOS Release 12.1(2)T.
12.1(8a)E	This command was integrated into Cisco IOS Release 12.1(8a)E.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.4(5)	The **vrf** *vrf-name* keyword/argument pair was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **mpls ldp router-id** command allows you to use the IP address of an interface as the LDP router ID.

The following steps describe the normal process for determining the LDP router ID:

1. The router considers all the IP addresses of all operational interfaces.
2. If these addresses include loopback interface addresses, the router selects the largest loopback address. Configuring a loopback address helps ensure a stable LDP ID for the router, because the state of loopback addresses does not change. However, configuring a loopback interface and IP address on each router is not required.

   The loopback IP address does not become the router ID of the local LDP ID under the following circumstances:

   – If the loopback interface has been explicitly shut down.

   – If the **mpls ldp router-id** command specifies that a different interface should be used as the LDP router ID.

   If you use a loopback interface, make sure that the IP address for the loopback interface is configured with a /32 network mask. In addition, make sure that the routing protocol in use is configured to advertise the corresponding /32 network.
3. Otherwise, the router selects the largest interface address.

The router might select a router ID that is not usable in certain situations. For example, the router might select an IP address that the routing protocol cannot advertise to a neighboring router.

The router implements the router ID the next time it is necessary to select an LDP router ID. The effect of the command is delayed until the next time it is necessary to select an LDP router ID, which is typically the next time the interface is shut down or the address is deconfigured.

If you use the **force** keyword with the **mpls ldp router-id** command, the router ID takes effect more quickly. However, implementing the router ID depends on the current state of the specified interface:

- If the interface is up (operational) and its IP address is not currently the LDP router ID, the LDP router ID is forcibly changed to the IP address of the interface. This forced change in the LDP router ID tears down any existing LDP sessions, releases label bindings learned via the LDP sessions, and interrupts MPLS forwarding activity associated with the bindings.
- If the interface is down, the LDP router ID is forcibly changed to the IP address of the interface when the interface transitions to up. This forced change in the LDP router ID tears down any existing LDP sessions, releases label bindings learned via the LDP sessions, and interrupts MPLS forwarding activity associated with the bindings.

The following behaviors apply to the default VRF as well as to VRFs that you explicitly configure with the **vrf** *vrf-name* keyword/argument pair:

- The interface you select as the router ID of the VRF must be associated with the VRF.
- If the interface is no longer associated with the VRF, the **mpls ldp router-id** command that uses the interface is removed.
- If the selected interface is deleted, the **mpls ldp router-id** command that uses the interface is removed.
- If you delete a VRF that you configured, the **mpls ldp router-id** command for the deleted VRF is removed. The default VRF cannot be deleted.

Examples

The following example shows that the POS2/0/0 interface has been specified as the preferred interface for the LDP router ID. The IP address of that interface is used as the LDP router ID.

```
Router(config)# mpls ldp router-id pos2/0/0
```

The following example shows that the Ethernet 1/0 interface, which is associated with the VRF vpn-1, is the preferred interface. The IP address of the interface is used as the LDP router ID.

```
Router(config)# mpls ldp router-id vrf vpn-1 eth1/0
```

Related Commands

Command	Description
show mpls ldp discovery	Displays the status of the LDP discovery process.

name (MST)

To set the name of a Multiple Spanning Tree (MST) region, use the **name** command in MST configuration submode. To return to the default name, use the **no** form of this command.

name *name*

no name *name*

Syntax Description

name	Name to give the MST region. It can be any string with a maximum length of 32 characters.

Command Default

Empty string

Command Modes

MST configuration (config-mst)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Two or more Cisco 7600 series routers with the same VLAN mapping and configuration version number are considered to be in different MST regions if the region names are different.

Caution Be careful when using the **name** command to set the name of an MST region. If you make a mistake, you can put the device in a different region. The configuration name is a case-sensitive parameter.

Examples

This example shows how to name a region:

```
Router(config-mst)# name Cisco
Router(config-mst)#
```

Related Commands

Command	Description
instance	Maps a VLAN or a set of VLANs to an MST instance.
revision	Sets the revision number for the MST configuration.
show	Verifies the MST configuration.
show spanning-tree mst	Displays the information about the MST protocol.
spanning-tree mst configuration	Enters MST configuration submode.

neighbor (OSPF)

To configure Open Shortest Path First (OSPF) routers interconnecting to nonbroadcast networks, use the **neighbor** command in router address family topology or router configuration mode. To remove a configuration, use the **no** form of this command.

neighbor *ip-address* [**priority** *number*] [**poll-interval** *seconds*] [**cost** *number*] [**database-filter all**]

no neighbor *ip-address* [**priority** *number*] [**poll-interval** *seconds*] [**cost** *number*] [**database-filter all**]

Syntax Description

ip-address	Interface IP address of the neighbor.
priority *number*	(Optional) A number that indicates the router priority value of the nonbroadcast neighbor associated with the IP address specified. The default is 0. This keyword does not apply to point-to-multipoint interfaces.
poll-interval *seconds*	(Optional) A number value that represents the poll interval time (in seconds). RFC 1247 recommends that this value be much larger than the hello interval. The default is 120 seconds (2 minutes). This keyword does not apply to point-to-multipoint interfaces. The range is from 0 to 4294967295 seconds.
cost *number*	(Optional) Assigns a cost to the neighbor, in the form of an integer from 1 to 65535. Neighbors with no specific cost configured will assume the cost of the interface, based on the **ip ospf cost** command. For point-to-multipoint interfaces, the cost keyword and the *number* argument are the only options that are applicable. This keyword does not apply to nonbroadcast multiaccess (NBMA) networks.
database-filter all	(Optional) Filters outgoing link-state advertisements (LSAs) to an OSPF neighbor.

Command Default

This command is disabled by default. No configuration is specified.

Command Modes

Router address family topology configuration (config-router-af-topology)
Router configuration (config-router)

Command History

Release	Modification
10.0	This command was introduced.
11.3AA	The **cost** keyword was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was made available in router address family topology configuration mode.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

X.25 and Frame Relay provide an optional broadcast capability that can be configured in the map to allow OSPF to run as a broadcast network. At the OSPF level you can configure the router as a broadcast network. Refer to the **x25 map** and **frame-relay map** commands in the "X.25 Commands" and "Frame Relay Commands" chapters, respectively, in the *Cisco IOS Wide-Area Networking Command Reference* for more detail.

One neighbor entry must be included in the Cisco IOS software configuration for each known nonbroadcast network neighbor. The neighbor address must be on the primary address of the interface.

If a neighboring router has become inactive (hello packets have not been received for the Router Dead Interval period), it may still be necessary to send hello packets to the dead neighbor. These hello packets will be sent at a reduced rate called *Poll Interval*.

When the router first starts up, it sends only hello packets to those routers with nonzero priority, that is, routers that are eligible to become designated routers (DRs) and backup designated routers (BDRs). After the DR and BDR are selected, DR and BDR will then start sending hello packets to all neighbors in order to form adjacencies.

Note You cannot use the **neighbor (OSPF)** command to specify an Open Shortest Path First (OSPF) neighbor on non-broadcast networks within an OSPF Virtual Private Network (VPN) routing instance.

Prior to Cisco IOS Release 12.0, the **neighbor** command applied to NBMA networks only. With Release 12.0, the **neighbor** command applies to NBMA networks and point-to-multipoint networks. On NBMA networks, the **cost** keyword is not accepted.

Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **neighbor** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

Examples

The following example declares a router at address 192.168.3.4 on a nonbroadcast network, with a priority of 1 and a poll interval of 180 seconds:

```
router ospf
 neighbor 192.168.3.4 priority 1 poll-interval 180
```

The following example illustrates a point-to-multipoint network with nonbroadcast:

```
interface Serial0
ip address 10.0.1.1 255.255.255.0
ip ospf network point-to-multipoint non-broadcast
encapsulation frame-relay
no keepalive
frame-relay local-dlci 200
frame-relay map ip 10.0.1.3 202
frame-relay map ip 10.0.1.4 203
frame-relay map ip 10.0.1.5 204
no shut
!
```

```
router ospf 1
network 10.0.1.0 0.0.0.255 area 0
neighbor 10.0.1.3 cost 5
neighbor 10.0.1.4 cost 10
neighbor 10.0.1.5 cost 15
```

Related Commands

Command	Description
ip ospf priority	Sets the router priority, which helps determine the designated router for this network.

neighbor remote-as (BGP)

To add an entry to the BGP or multiprotocol BGP neighbor table, use the **neighbor remote-as** command in router configuration mode. To remove an entry from the table, use the **no** form of this command.

neighbor {*ip-address* | *peer-group-name*} **remote-as** *autonomous-system-number* [**alternate-as** *autonomous-system-number ...*]

no neighbor {*ip-address* | *peer-group-name*} **remote-as** *autonomous-system-number* [**alternate-as** *autonomous-system-number ...*]

Syntax Description

ip-address	IP address of the neighbor.
peer-group-name	Name of a BGP peer group.
autonomous-system-number	Number of an autonomous system to which the neighbor belongs in the range from 1 to 65535. For more details about autonomous system number formats, see the **router bgp** command. When used with the **alternate-as** keyword, up to five autonomous system numbers may be entered.
alternate-as	(Optional) Specifies an alternate autonomous system in which a potential dynamic neighbor can be identified.

Command Default

There are no BGP or multiprotocol BGP neighbor peers.

Command Modes

Router configuration (config-router)

Command History

Release	Modification
10.0	This command was introduced.
11.0	The *peer-group-name* argument was added.
11.1(20)CC	The **nlri unicast**, **nlri multicast**, and **nlri unicast multicast** keywords were added.
12.0(7)T	The **nlri unicast**, **nlri multicast**, and **nlri unicast multicast** keywords were removed.
12.2(4)T	Support for the IPv6 address family was added.
12.2(25)SG	This command was integrated into Cisco IOS Release 12.2(25)SG.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was modified. The **%** keyword was added.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH. The **alternate-as** keyword was added to support BGP dynamic neighbors.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
Cisco IOS XE Release 2.1	This command was introduced on Cisco ASR 1000 Series Routers.

Release	Modification
12.0(32)S12	Support for 4-byte autonomous system numbers in asdot notation only was added.
12.0(32)SY8	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.
12.4(24)T	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
Cisco IOS XE Release 2.3	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
12.2(33)SXI1	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.
12.0(33)S3	This command was modified. Support for asplain notation was added and the default format for 4-byte autonomous system numbers is now asplain.
Cisco IOS XE Release 2.4	This command was modified. Support for asplain notation was added and the default format for 4-byte autonomous system numbers is now asplain.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Specifying a neighbor with an autonomous system number that matches the autonomous system number specified in the **router bgp** global configuration command identifies the neighbor as internal to the local autonomous system. Otherwise, the neighbor is considered external.

If you specify a BGP peer group by using the *peer-group-name* argument, all the members of the peer group will inherit the characteristic configured with this command.

By default, neighbors that are defined using the **neighbor remote-as** command in router configuration mode exchange only unicast address prefixes. To exchange other address prefix types, such as multicast and Virtual Private Network (VPN) Version 4, neighbors must also be activated in the appropriate address family configuration mode.

To ensure a smooth transition, we recommend that all BGP speakers within an autonomous system that is identified using a 4-byte autonomous system number, be upgraded to support 4-byte autonomous system numbers.

Examples

The following example specifies that a router at the address 10.108.1.2 is an internal BGP (iBGP) neighbor in autonomous system number 65200:

```
router bgp 65200
 network 10.108.0.0
 neighbor 10.108.1.2 remote-as 65200
```

The following example assigns a BGP router to autonomous system 65400, and two networks are listed as originating in the autonomous system. Then the addresses of three remote routers (and their autonomous systems) are listed. The router being configured will share information about networks 10.108.0.0 and 192.168.7.0 with the neighbor routers. The first router is a remote router in a different autonomous system from the router on which this configuration is entered (an eBGP neighbor); the second **neighbor remote-as** command shows an internal BGP neighbor (with the same autonomous

system number) at address 10.108.234.2; and the last **neighbor remote-as** command specifies a neighbor on a different network from the router on which this configuration is entered (also an eBGP neighbor).

```
router bgp 65400
 network 10.108.0.0
 network 192.168.7.0
 neighbor 10.108.200.1 remote-as 65200
 neighbor 10.108.234.2 remote-as 65400
 neighbor 172.29.64.19 remote-as 65300
```

The following example configures neighbor 10.108.1.1 in autonomous system 65001 to exchange only multicast routes:

```
router bgp 65001
 neighbor 10.108.1.1 remote-as 65001
 neighbor 172.31 1.2 remote-as 65001
 neighbor 172.16.2.2 remote-as 65002
 address-family ipv4 multicast
  neighbor 10.108.1.1 activate
  neighbor 172.31 1.2 activate
  neighbor 172.16.2.2 activate
  exit-address-family
```

The following example configures neighbor 10.108.1.1 in autonomous system 65001 to exchange only unicast routes:

```
router bgp 65001
 neighbor 10.108.1.1 remote-as 65001
 neighbor 172.31 1.2 remote-as 65001
 neighbor 172.16.2.2 remote-as 65002
```

Related Commands

Command	Description
router bgp	Configures the BGP routing process.

network-clock clear wait-to-restore

To stop the wait-to-restore timer for a clock source, use the **network-clock clear wait-to-restore** command in privileged EXEC mode.

network-clock clear wait-to-restore {interface *interface-name slot/card/port* **| controller {e1 | BITS}** *slot/port***}**

Syntax Description

interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
controller	Specifies the controller connected to the clock source.
e1	Specifies the E1 controller.
BITS	Specifies the BITS controller.
slot	The slot of Router/Switch where card is present.
port	The port in the card.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command can cause the router to switch clock sources by restoring a previous clock source.

Examples

This example shows how to use the **network-clock clear wait-to-restore** command:

```
Router# network-clock clear wait-to-restore controller e1 0/0
```

Related Commands

Command	Description
network-clock clear lockout	Clears a lockout condition and makes a network clock input available for clock selection.
network-clock clear switch	Clears a forced switch or manual switch state from a synchronous Ethernet interface.

network-clock eec

To specify the Ethernet Equipment Clock (EEC) type, use the **network-clock eec** command in global configuration mode. To remove an EEC configuration use the **no** form of this command.

network-clock eec {1 | 2}

no network-clock eec {1 | 2}

Syntax Description

1	ITU-T G.8262 option 1
2	ITU-T G.8262 option 2 and Telcordia GR-1244

Command Default

1

Command Modes

Global configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

You can use the **network-clock synchronization ssm option** command to automatically set the correct EEC option.

Examples

This example shows how to configure the EEC type:

```
Router# configure terminal
Router(config)# network-clock eec 1
Router(config)#
```

Related Commands

Command	Description
network clock synchronization	Configures the router to exchange timing messages using the G.781 synchronization option 1 or 2.

network-clock external hold-off

To override the hold-off timer value for an external interface, use the **network-clock external hold-off** command in configuration mode. To remove a configuration use the **no** form of this command.

network-clock external *slot/card/port* **hold-off {0 | *timer-value*}**

no network-clock external ***slot/card/port*** **hold-off {0 | *timer-value*}**

Syntax Description

slot	The slot of where card is present.
card	The card in the router.
port	The port in the card.
0	Disables the hold-off timer.
timer-value	The value of the new hold-off timer for the external clock source, in milliseconds. The range is from 50 to 10000. **Note** Values above 1800 can cause the clock to go into holdover mode.

Command Default

None

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

A network holdoff timer determines the amount of time that the router waits when a synchronous Ethernet clock source fails before taking action. After the holdoff timer expires, the router announces the failure and switches to another clock source or holdover mode.

Examples

This example shows how to configure an external hold-off timer:

```
Router(config)# network-clock external 0/1/2 hold-off 200
Router(config)#
```

Related Commands

Command	Description
network-clock hold-off	Configures a hold-off value on an interface.
network-clock hold-off global	Configure a general hold-off timer.

network-clock hold-off

To configure a hold-off value on an interface, use the **network-clock hold-off** command in interface configuration mode. To remove a hold-off configuration, use the **no** form of this command.

network-clock hold-off {0 | *hold-off-value*}

no network-clock hold-off {0 | *hold-off-value*}

Syntax Description

0	Disables the hold-off timer.
hold-off-value	A warning will be displayed for any value below 300 ms and above 1800 ms.

Command Default

300

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

A network holdoff timer determines the amount of time that the router waits when a synchronous Ethernet clock source fails before taking action. After the holdoff timer expires, the router announces the failure and switches to another clock source or holdover mode.

This command only applies to synchronous Ethernet interfaces.

Examples

This example shows how to configure a hold-off timer value on an interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet0/0
Router(config-if)# network-clock hold-off 400
Router(config-if)#
```

Related Commands

Command	Description
network-clock external hold-off	To override the hold-off timer value for an external interface
network-clock hold-off global	Configure a general hold-off timer.

network-clock hold-off global

To configure a general hold-off timer, use the **network-clock hold-off global** command in global configuration mode. To disable a general hold-off timer, use the **no** form of this command.

network-clock hold-off {0 | *hold-off-value***} global**

no network-clock hold-off {0 | ***hold-off-value***} global**

Syntax Description

0	Disables the hold-off timer.
hold-off-value	A warning will be displayed for any value below 300 ms and above 1800 ms.

Command Default

300 ms

Command Modes

Configuration mode (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

A network holdoff timer determines the amount of time that the router waits when a synchronous Ethernet clock source fails before taking action. After the holdoff timer expires, the router announces the failure and switches to another clock source or holdover mode.

Examples

This example shows how to configure a global hold-off timer value:

```
Router(config)# network-clock hold-off 400 global
Router(config)#
```

Related Commands

Command	Description
network-clock external hold-off	To override the hold-off timer value for an external interface
network-clock hold-off	Configures a hold-off value on an interface.

network-clock input-source

To select an interface or external timing input as a clock source and set a priority for the clock, use the **network-clock input-source** command in configuration mode. To remove a clock source, use the **no** form of this command.

network-clock input-source *priority* {**interface** *interface-name slot/card/port* | **external** [**2m** | **10m**] | **controller** [**BITS** | **E1 slot/port**]}

no network-clock input-source *priority* {**controller BITS** | **E1**} | {**interface** *type slot/card/port*] {**external 2m** | **10m**}}

Syntax Description

priority	The priority of the clock source. The range is from 1 to 250.
interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
external	Specifies an external interface.
2m	Specifies the 2 MHz interface.
10m	Specifies the 10 MHz interface.
controller	Specifies the controller connected to the clock source.
e1	Specifies the E1 controller.
BITS	Specifies the BITS controller.

Command Default

None

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

During clock selection, the router considers clock sources according to their priority value.

Examples

This example shows how to specify an input clock source:

```
Router(config)# network-clock input-source 5 10m
Router(config)#
```

Related Commands

Command	Description
network-clock output-source	Transmits clocking to an external timing sources using timing output interfaces.

network-clock output-source

To transmit clocking to an external timing source using a timing output interface, use the **network-clock output-source** command in configuration mode. To disable clocking output, use the **no** form of this command.

network-clock output-source line *priority* **{interface** *interface-name slot/card/port* **| controller {t1 | e1}** *slot/card/port}* **{external** *slot/card/port* **[t1 {sf | esf | d4} | e1 [crc4| fas| cas [crc4]] | j1| 2m | 10m]**

no network-clock output-source line ***priority*** **{interface** ***interface-name slot/card/port*** **| controller {t1 | e1}** ***slot/card/port}*** **{external** ***slot/card/port*** **[t1 {sf | esf | d4} | e1 [crc4| fas| cas [crc4]] | j1| 2m | 10m]**

Syntax Description

priority	The priority of the clock source. The range is from 1 to 250.
interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
controller	Specifies the controller connected to the clock source.
t1	Specifies the T1 controller.
e1	Specifies the E1 controller.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
external	Specifies an external interface.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
t1	Specifies a T1 interface.
sf	Specifies SF framing on the T1 interface.
esf	Specifies T1 ESF framing on the T1 interface.
d4	Specifies D4 framing on the T1 interface.
e1	Specifies an E1 interface.
crc4	Specifies CRC4 framing on the E1 interface.
fas	Specifies FAS framing on the E1 interface.
cas	Specifies CAS signaling on a T1 interface.
crc4	Specifies CRC4 framing on the E1 interface.
j1	Specifies the J1 interface.
2m	Specifies the 2 MHz interface.
10m	Specifies the 10 MHz interface.

Defaults

Clocking output is disabled by default.

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

The router selects clock output interfaces based on the priority value of the clock output source.

Examples

This example shows how to configure an output clock source:

```
Router(config)# network-clock output-source 10 10m
Router(config)#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock output-source line	Transmits clocking received from an external source to another external device using timing output interfaces.

network-clock output-source line

To transmit clocking received from an external source to another external device using timing output interfaces, use the **network-clock output-source line** command in configuration mode. To disable clocking output, use the **no** form of this command.

network-clock output-source line *priority* **{interface** *interface-name slot/card/port* **| controller {t1 | e1}** *slot/card/port}* **{external** *slot/card/port* **[t1 {sf | esf | d4} | e1 [crc4| fas| cas [crc4]] | j1| 2m | 10m]**

no network-clock output-source line ***priority*** **{interface** ***interface-name slot/card/port*** **| controller {t1 | e1}** ***slot/card/port}*** **{external** ***slot/card/port*** **[t1 {sf | esf | d4} | e1 [crc4| fas| cas [crc4]] | j1| 2m | 10m]**

Syntax Description

priority	The priority of the clock source. The range is from 1 to 250.
interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
controller	Specifies the controller connected to the clock source.
t1	Specifies the T1 controller.
e1	Specifies the E1 controller.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
external	Specifies an external interface.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
t1	Specifies a T1 interface.
sf	Specifies SF framing on the T1 interface.
esf	Specifies T1 ESF framing on the T1 interface.
d4	Specifies D4 framing on the T1 interface.
e1	Specifies an E1 interface.
crc4	Specifies CRC4 framing on the E1 interface.
fas	Specifies FAS framing on the E1 interface.
cas	Specifies CAS signaling on a T1 interface.
crc4	Specifies CRC4 framing on the E1 interface.
j1	Specifies the J1 interface.
2m	Specifies the 2 MHz interface.
10m	Specifies the 10 MHz interface.

Defaults Output clocking is disabled by default.

Command Modes Configuration mode (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines The router selects clock output interfaces based on the priority value of the clock output source.

Examples This example shows how to configure an output clock source:

```
Router(config)# network-clock output-source line 10 10m
Router(config)#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock output-source	Transmits clocking to an external timing source using a timing output interface.

network-clock quality-level

To specify a quality level for a line or external timing device, use the **network-clock quality-level** command in global configuration mode. To remove a quality-level configuration, use the **no** form of this command.

network-clock quality-level {**tx** | **rx**} *value* {**interface** *interface-name slot/card/port* | **controller** [**E1| BITS]** *slot/card/port* | **external** [**2m** | **10m**] }

no network-clock quality-level {**tx** | **rx**} *value* {**interface** *interface-name slot/card/port* | **controller** [**E1| BITS]** *slot/card/port* | **external** [**2m** | **10m**] }

Syntax Description

tx	Specifies a quality level for transmitted traffic.
rx	Specifies a quality level for received traffic.
value	Defines the quality level. Valid values are: • QL-PRC • QL-SSU-A • QL-SSU-B • QL-SEC • QL-DNU
interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
controller	Specifies the controller connected to the clock source.
e1	Specifies the E1 controller.
BITS	Specifies the BITS controller.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
external	Specifies an external interface.
2m	Specifies the 2 MHz interface.
10m	Specifies the 10 MHz interface.

Command Default

None

Command Modes

Global configuration mode

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command only applies to synchronous Ethernet interfaces.

Examples

This example shows how to configure a quality-level value:

```
Router(config)# network-clock quality-level rx QL-DNU controller BITS
Router(config)#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock source quality-level	Specifies a quality level for a clock source.

network-clock revertive

To specify whether the router reverts to a higher priority clock when it becomes available, use the **network-clock revertive** command in global configuration mode. To disable this behavior, use the **no** form of this command.

Syntax Description

This command has no arguments or keywords.

Command Default

None

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

Revertive behavior does not apply when the router switches between two clocks of equal priority; the router only reverts when a higher-priority clock becomes available.

Examples

This example shows how to configure the revertive clocking behavior:

```
Router(config)# network-clock revertive
Router(config)#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock output-source	Transmits clocking to an external timing source using a timing output interface.

network-clock source quality-level

To specify a quality level for a clock source, use the **network-clock source quality-level** command in interface configuration mode. To remove a quality-level configuration, use the **no** form of this command.

network-clock source quality-level {tx | rx} ***value***

no network-clock source quality-level {tx | rx} *value*

Syntax Description

tx	Specifies a quality level for transmitted traffic.
rx	Specifies a quality level for received traffic.
value	Defines the quality level. Valid values are: QL-PRC, QL-SSU-A, QL-SSU-B, QL-SEC, and QL-DNU.

Command Default

This command is disabled by default.

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

You can use this command to override the quality level value of a network clock; the command inserts a value into the local clock selection process that is considered as a value received from the network.

Examples

This example shows how to configure a network clock source quality level:

```
Router# configure terminal
Router(config)# interface gigabitethernet 0/1
Router(config-if) network-clock source quality-level ql-prc tx
Router(config-if)# end
Router#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock output-source	Transmits clocking to an external timing source using a timing output interface.
network-clock quality-level	To specify a quality level for a line or external timing device.

network-clock synchronization automatic

To enable automatic selection of a clock synchronization source, use the **network-clock synchronization automatic** command in global configuration mode. To disable automatic clock selection, use the **no** form of this command.

network-clock synchronization automatic

no network-clock synchronization automatic

Syntax Description

This command has no arguments or keywords.

Command Default

This command is disabled by default.

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command enables automatic clock selection based on the G.781 standard.

To use this command, you must remove any network-clock select statements from the router configuration.

Examples

This example shows how to enable automatic clock synchronization:

```
Router(config)# network-clock synchronization automatic
Router(config)#
```

Related Commands

Command	Description
network-clock select	Names a source to provide timing for the network clock and to specifies the selection priority for the clock source.

network-clock synchronization mode ql-enabled

To configure automatic selection of a clock source based on quality level (QL), use the **network-clock synchronization mode ql-enabled** command in configuration mode. To disable clock selection based on quality level, use the **no** form of this command.

network-clock synchronization mode QL-enabled

no network-clock synchronization mode QL-enabled

Syntax Description

No arguments or keywords.

Command Default

Source selection based on quality level is disabled by default.

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

Enabling clock selection based on quality level requires a synchronization interface that can send SSM messages.

Examples

This example shows how to enable QL-enabled synchronization mode:

```
Router(config)# network-clock synchronization mode QL-enabled
Router(config)#
```

Related Commands

Command	Description
synchronous mode	To set an Ethernet interface in synchronous mode

network-clock synchronization participate

To configure the router to exchange timing messages using the G.781 synchronization option 1 or 2, use the **network-clock synchronization participate** command in global configuration mode. To disable a G.781 synchronization option, use the **no** form of this command.

network-clock synchronization ssm option {1| 2 {GEN1 | GEN2}}

no network-clock synchronization ssm option {1| 2 {GEN1 | GEN2}}

Syntax Description

1	Configures G.781 synchronization option 1; this option is for use with European synchronization networks.
2	Configures G.781 synchronization option 2; this option is for use with North American synchronization networks.
GEN1	Specifies option 2 Generation 1 synchronization.
GEN2	Specifies option 2 Generation 2 synchronization.

Command Default

1

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This option is only available if supported by the router.

Examples

This example shows how to name a region:

```
Router(config)# network-clock synchronization ssm option 2 GEN1
Router(config)#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock output-source	Transmits clocking to an external timing source using a timing output interface.

network-clock synchronization ssm option

To configure the router to exchange timing messages using the G.781 synchronization option 1 or 2, use the **network-clock synchronization ssm option** command in global configuration mode. To disable a G.781 synchronization option, use the **no** form of this command.

network-clock synchronization ssm option {1| 2 {GEN1 | GEN2}}

no network-clock synchronization ssm option {1| 2 {GEN1 | GEN2}}

Syntax Description

1	Configures G.781 synchronization option 1; this option is for use with European synchronization networks.
2	Configures G.781 synchronization option 2; this option is for use with North American synchronization networks.
GEN1	Specifies option 2 Generation 1 synchronization.
GEN2	Specifies option 2 Generation 2 synchronization.

Command Default

1

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This option is only available if supported by the router.

Examples

This example shows how to name a region:

```
Router(config)# network-clock synchronization ssm option 2 GEN1
Router(config)#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock output-source	Transmits clocking to an external timing source using a timing output interface.

network-clock wait-to-restore

To configure the amount of time that an interface waits before reverting to a restored clock source, use the **network-clock wait-to-restore** command in global configuration mode. To remove a wait-to-restore configuration, use the **no** form of this command.

network-clock wait-to-restore *timer-value*

no network-clock wait-to-restore ***timer-value***

Syntax Description

timer-value	The length of the timer in seconds. The range is from 0 to 86400.

Command Default

300 seconds or 5 minutes.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command only applies to synchronous Ethernet interfaces.

Using a low wait-to-restore value can cause timing flaps if the connection to a clock source is repeatedly interrupted. We recommend a minimum value of 50 seconds to avoid timing flaps.

Examples

This example shows how to configure a wait-to-restore timer:

```
Router(config-if)# network-clock wait-to-restore 200
Router(config-if)#
```

Related Commands

Command	Description
network-clock input-source	Selects an interface or external timing input as a clock source and sets a priority for the clock.
network-clock output-source	Transmits clocking to an external timing source using a timing output interface.
network-clock revertive	Specifies whether the router reverts to a higher priority clock when it becomes available.
network-clock wait-to-restore global	Configures the amount of time that the router waits before reverting to a restored clock source.

network-clock wait-to-restore global

To configure the amount of time that the router waits before reverting to a restored clock source, use the **network-clock wait-to-restore** command in global configuration mode. To remove a wait-to-restore configuration, use the **no** form of this command.

network-clock wait-to-restore *timer-value* **global**

no network-clock wait-to-restore ***timer-value*** **global**

Syntax Description

timer-value	The length of the timer in seconds. The range is from 0 to 86400.

Defaults

300 seconds or 5 minutes.

Command Modes

Global configuration (config)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

Using a low wait-to-restore value can cause timing flaps if the connection to a clock source is repeatedly interrupted. We recommend a minimum value of 50 seconds to avoid timing flaps.

Examples

This example shows how to configure a wait-to-restore timer:

```
Router(config)# network-clock wait-to-restore 200
Router(config)#
```

Related Commands

Command	Description
network-clock wait-to-restore	To configure the amount of time that an interface waits before reverting to a restored clock source

network-clock-select

The **network-clock-select** command names a source to provide timing for the network clock and to specify the selection priority for the clock source. To remove a network-clock-select configuration, use the **no** form of this command.

network-clock-select *priority* **{bits | synce {port} | packet_timing} {E1 | T1** *slot/port***} {10M | 2.048M | 1.544M}**

no network-clock-select ***priority*** **{bits | synce {port} | packet_timing} {E1 | T1** *slot/port***}**

Syntax Description

priority	A numeric value from 1–24 that specifies the priority of the clock source.
bits	Specifies timing from a BITS port clock.
synce	Specifies timing using synchronous Ethernet.
port	Specifies the port on which synchronous Ethernet is enabled.
packet_timing	Enables packet timing using the RTM module.
E1	Specifies clocking using an E1 interface.
T1	Specifies clocking using a T1 interface.
slot/port	Specifies the slot and port of the interface used for timing.
10M	Specifies clocking at 10Mhz using the 10 Mhz timing port.
2.048M	Specifies clocking at 2.048 Mhz using the 10 Mhz timing port.
1.544M	Specifies clocking at 1.544 Mhz using the 10 Mhz timing port.

Defaults

There is no default setting.

Command Modes

Global configuration

Command History

Release	Modification
11.3 MA	This command was introduced on the Cisco MC3810.
12.0(3)XG	The BVM as a possible network clock source was added.
12.1(5)XM	This command was implemented on the Cisco 3660. The keywords t1 and e1 were introduced.
12.2(4)T	This command was integrated into Cisco IOS Release 12.2(4)T.
12.2(2)XB	This command was implemented on the Cisco 2600 series and Cisco 3660 with AIMs installed.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.2(15)T	This command was implemented on the Cisco 2600XM, Cisco 2691, Cisco 3725, and Cisco 3745.
12.3(8)T4	This command was integrated into Cisco IOS Release 12.3(8)T4 and the bri keyword was added. Support was also added for the Cisco 2800 series.

Release	Modification
12.3(11)T	This command was integrated into Cisco IOS Release 12.3(11)T and the atm keyword was added. Support was also added for the Cisco 3800 series.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the **network-clock-select** command:

```
Router# config t
Router(config)# network-clock-select 1 packet_timing
Router(config)# exit
```

Related Commands

Command	Description
set network-clocks force-reselect	Forces the router to re-select the network clock.

network-clock-select hold-timeout

The **network-clock-select hold-timeout** command specifies how long the router waits before reevaluating the network clock entry. To remove a **network-clock-select hold-timeout** configuration, use the **no** form of this command.

network-clock-select hold-timeout {*timeout* | **infinite**}

no network-clock-select hold-timeout {*timeout* | **infinite**}

Syntax Description

timeout	A value in seconds that specifies how long the router waits before reevaluating the network clock entry. Valid values are a number from 0–86400.
infinite	Specifies an infinite holdover.

Defaults

The default setting is **network-clock-select hold-timeout infinite**.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the **network-clock-select** command:

```
Router# config t
Router(config)# network-clock-select hold-timeout 2000
Router(config)# exit
```

Related Commands

Command	Description
set network-clocks force-reselect	Forces the router to re-select the network clock.

network-clock-select hold-off-timeout

Determines that the time in milliseconds that the Cisco MWR 2941 waits when a synchronous Ethernet clock source fails before taking action. After the holdoff timer expires, the router announces the failure and takes one of the following actions depending on the clocking configuration:

- Considers other clock sources
- Switches to holdover mode—The router generates a timing signal based on the stored timing reference.

The **network-clock-select hold-timeout** command specifies how long the router waits before reevaluating the network clock entry. To remove a **network-clock-select hold-off-timeout** configuration, use the **no** form of this command.

network-clock-select hold-timeout *duration*

no network-clock-select hold-timeout *duration*

Syntax Description

duration	Valid values are 0 or 50–10000

Defaults

The default setting is **network-clock-select hold-timeout infinite**.

Command Modes

Global configuration

Command History

Release	Modification
12.2(33)MRA	This command was introduced.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The holdoff timer is a global timer value; it applies to both synchronous Ethernet clock sources when configured.

Examples

The following example shows how to use the **network-clock-select** command:

```
Router# config t
Router(config)# network-clock-select hold-timeout 2000
Router(config)# exit
```

Related Commands

Command	Description
set network-clocks force-reselect	Forces the router to re-select the network clock.

network-clock-select input-stratum4

The **network-clock-select input-stratum4** command allows you to downgrade a clock source from Stratum3 to Stratum 4. To configure a clock source as Stratum 3, use the **no** form of this command.

network-clock-select input-stratum4

no network-clock-select input-stratum4

Defaults

The default setting is for onboard E1/T1 ports is Stratum 3; the default setting for E1/T1 HWIC ports is Stratum 4.

Note You cannot configure E1/T1 HWIC ports as Stratum3.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the **network-clock-select** command:

```
Router# config t
Router(config)# network-clock-select input-stratum4
Router(config)# exit
```

Related Commands

Command	Description
set network-clocks force-reselect	Forces the router to re-select the network clock.

network-clock-select mode

The **network-clock-select mode** command specifies the router switching mode when recovering from a failure. To remove a **network-clock-select mode** configuration, use the **no** form of this command.

network-clock-select mode {revert | nonrevert}

no network-clock-select mode {revert | nonrevert}

Syntax Description

nonrevert	Sets the network clock to non-revertive mode.
revert	Sets the network clock to revertive mode.

Defaults

The default setting is **network-clock-select mode nonrevert**.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the **network-clock-select** command:

```
Router# config t
Router(config)# network-clock-select mode revert
Router(config)# exit
```

Related Commands

Command	Description
set network-clocks force-reselect	Forces the router to re-select the network clock.

network-clock-select wait-to-restore-timeout

Specifies the amount of time in seconds that the Cisco MWR 2941 waits before considering a new clock source.

network-clock-select wait-to-restore-timeout *duration*

no network-clock-select wait-to-restore-timeout *duration*

Syntax Description

duration	Specifies the timer value in seconds. Valid values are 0–720 or up to 12 minutes. The default value is 300 seconds (5 minutes).

Defaults

The default setting is **network-clock-select wait-to-restore 300**.

Command Modes

Global configuration

Command History

Release	Modification
12.2(33)MRA	This command was introduced.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The restore timer is a global timer value; it applies to both synchronous Ethernet clock sources when configured.

Examples

The following example shows how to use the **network-clock-select** command:

```
Router# config t
Router(config)# network-clock-select wait-to-restore 360
Router(config)# exit
```

Related Commands

Command	Description
set network-clocks force-reselect	Forces the router to re-select the network clock.

payload-size

Specifies the size of the payload for packets on a structured CEM channel.

payload-size [*payload-size*]

Syntax Description

payload-size	Specifies the size of the payload for packets on a structured CEM channel. Valid values are 16–512. **Note** The payload size must be a multiple of the number of timeslots for the CEM channel. The default payload size is calculated as follows: 8 x number of timeslots x 1 ms packetization delay

Defaults

For SAToP, the default packetization delay is 1ms, and so the default payload size for a T1 is 192 bytes; and for an E1 is 256 bytes.

On the other hand, the default payload size for a structured CEM channel (CESoPSN) depends on the number of timeslots that constitute the channel.

In this case, the default packetization delay is 4 ms, so for example:

If 5 time slots are configured in the cem-group, then the accepted max payload value is 160 bytes.

If 10 time slots are configured in the cem-group, then the accepted max payload value is 320 bytes.

Command Modes

CEM circuit configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

For configuration of Out-of-Band Slave mode, the Cisco MWR 2941 only supports a payload size of 486 (625 packets per second) or 243 (1250 packets per second).

Examples

The following example shows how to specify a sample rate:

```
Router# config t
Router(config)# interface cem 0/0
Router(config-if)# no ip address
Router(config-if)# cem 0
Router(config-if-cem)# payload-size 256
Router(config-if-cem)# xconnect 10.10.10.10 200 encapsulation mpls
```

```
Router(config-if-cem-xconn)# exit
Router(config-if-cem)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
dejitter-buffer	Configures the size of the dejitter buffer on a CEM channel.
idle-pattern	Specifies the data pattern transmitted on the T1/E1 line when missing packets are detected on the PWE3 circuit.

period (CFM-AIS-link)

To configure a specific Alarm Indication Signal (AIS) transmission interval on a server maintenance endpoint (SMEP), use the **period** command in CFM SMEP AIS configuration mode. To remove the interval configuration, use the **no** form of this command.

period *seconds*

no period

Syntax Description

seconds	Integers 1 or 60 that specify the time interval, in seconds, between AIS transmissions. The default is 60.

Command Default

AIS frames are transmitted every 60 seconds.

Command Modes

CFM SMEP AIS configuration mode (config-ais-link-cfm)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
15.0(1)XA	This command was integrated into Cisco IOS Release 15.0(1)XA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When the default value is configured, "period 60" is displayed when the **show running all** command is issued.

Examples

The following example shows how to configure an AIS transmission interval of 1 second:

```
Router(config)# ethernet cfm ais link-status global
Router(config-ais-link-cfm)# period 1
```

Related Commands

Command	Description
show running all	Displays the running configuration with default values.

ping ethernet

To send Ethernet connectivity fault management (CFM) loopback messages (LBM) to a destination maintenance endpoint (MEP), use the **ping ethernet** command in privileged EXEC mode.

ping ethernet {*mac-address* | **mpid** *mpid* | **multicast**} {**domain** *domain-name* {**port** | **vlan** *vlan-id*}} [**cos** *cos-value* | **source** *source-mpid* [**cos** *cos-value*]] [**de**]

Syntax Description

mac-address	MAC address of the destination MEP in the format abcd.abcd.abcd.
mpid	Specifies a maintenance point identifier.
mpid	Integer from 1 to 8191 that identifies the MEP.
multicast	Specifies a multicast loopback message.
domain	Specifies the domain where the destination MEP resides.
domain-name	String of a maximum of 154 characters that identifies the domain.
port	Specifies a port MEP.
vlan	Specifies a VLAN.
vlan-id	Integer from 1 to 4094 that identifies the VLAN.
cos	(Optional) Specifies a class of service (CoS) for a MEP that will be sent in Ethernet CFM messages.
cos-value	(Optional) Integer from 0 to 7 that identifies the CoS. • The default is retrieved from the MEP identified by the maintenance endpoint ID (MPID) if the **cos** option is not configured. If the **mpid** option is not configured, the default is the highest priority on the egress interface.
source	(Optional) Specifies a MEP's class of service (CoS) that will be sent in Ethernet CFM messages.
source-mpid	(Optional) Integer from 1 to 8191 that identifies the source MEP.
de	(Optional) Specifies if the packet is drop eligible. The default is "false." • The **de** option is platform dependent.

Command Default

A CFM ping operation to the specified MEP is performed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. The **cos parameter was not supported in this release.**
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **level** keyword used to configure CFM Draft 1.0.

Usage Guidelines

Use this command to test connectivity between MEPs.

If the continuity check database does not have entries for the specified MPID, an error message is displayed notifying you to use the **ping ethernet** *mac-address* command instead.

If a domain name has more than 43 characters, a warning message is displayed notifying you that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

This command can be issued by specifying keywords and arguments as one command or as an "extended" command in which you specify options line by line.

Examples

The following examples show how to send an Ethernet CFM loopback message to a destination MEP using the "extended ping" format:

```
Router# ping

Protocol [ip]: ethernet
Multicast [n] :
Mac Address : aabb.cc03.bb99
Maintenance Domain : Domain_L5
VLAN [9]:
Source MPID [220]:
Repeat Count [5]:
Datagram Size [100]:
Timeout in seconds [5]:
Interval in seconds [0]:
Extended commands [n]:
Type escape sequence to abort.
Sending 5 Ethernet CFM loopback messages to aabb.cc03.bb99, timeout is 5 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms

Router# ping

Protocol [ip]: ethernet
Multicast [n] : y
Maintenance Domain : Domain_L5
VLAN [9]:
Source MPID [220]:
Datagram Size [100]:
Timeout in seconds [5]:
Interval in seconds [0]:
Extended commands [n]:
Type escape sequence to abort.
Sending 5 Ethernet CFM loopback messages to 0180.c200.0035, timeout is 5 seconds:
Reply to Multicast request from aabb.cc03.bb99, 0 ms

Total Remote MEPs replied: 1
```

ping ethernet mpid vlan



Note Effective with Cisco IOS Release 12.4(11)T, the **ping ethernet mpid vlan** command is replaced by the **ping ethernet vlan** command. See the **ping ethernet vlan** command for more information.

ping ethernet vlan

To send Ethernet connectivity fault management (CFM) loopback messages to a maintenance endpoint (MEP) or maintenance intermediate point (MIP) destination, use the **ping ethernet vlan** command in privileged EXEC command mode.

ping ethernet {*mac-address* | *mpid*} {**domain** *domain-name* | **level** *level-id*} **vlan** *vlan-id* [**source** *mpid*]

Syntax Description

mac-address	MAC address of the remote maintenance point in the format abcd.abcd.abcd.
mpid	Integer from 0 to 8191 that identifies the MEP.
domain	Indicates a domain is specified.
domain-name	String with a maximum of 154 characters that identifies the domain.
level	Indicates that a maintenance level is specified.
level-id	Integer value of 0 to 7 that identifies the maintenance level.
vlan-id	Integer value of 1 to 4094 that identifies the VLAN.
source *mpid*	(Optional) Indicates a source maintenance point.

Command Default

A basic CFM ping operation to the specified MAC address (MEP or MIP) is performed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	The optional **source** keyword and *mpid* argument were added in Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

A local MEP must be configured for the same level and VLAN before you can use this command.

The optional **source** keyword is available only when you enter a domain name. The **source** keyword is useful when there are multiple local MEPs in the same domain, level, and VLAN as the ping target. For outward facing MEPs, choosing the source MPID implicitly selects the interface from which the ping will be sent.

Examples

The following example shows how to send an Ethernet CFM loopback message to MAC address 4123.pcef.9879 at maintenance level 3, VLAN ID 4325:

```
Router# ping ethernet 4123.pcef.9879 level 3 vlan 4325
```

Related Commands

Command	Description
ping	Sends an echo request packet to an address, and then awaits a reply to determine whether a device can be reached or is functioning.

platform header-compression match access-group

To apply a named Access Control List (ACL) containing a list of static flows to a multilink interface to compress using IP header compression (IPHC), use the **platform header-compression match access-group** command in interface configuration mode:

platform header-compression match access-group *name*

no platform header-compression match access-group *name*

Syntax Description

name	Name of the extended named ACL of flows to compress using IPHC.

Defaults

None.

Command Modes

Interface configuration

Command History

Release	Modification
15.1(3)MR	This command was introduced.

Usage Guidelines

If a QoS policy is attached to the multilink interface on which IPHC has been enable, ensure that you configure the **platform header-compression match access-group** command in interface configuration mode to apply an extended named Access Control List (ACL) of static flows (source IP address, destination IP address, and destination port) to compress using IPHC.

You must configure the matching ACL as an extended named access-list and add the static flow configuration to a Multilink interface that is in an UP state and on which the **ip rtp header-compression** command is configured.

Examples

The following example applys an ACL named “iphcM1” to the Mutlilink1 interface:

```
Router> enable
Router# configure terminal
Router(config)# interface Multilink1
Router(config-if)# platform header-compression match access-group ipchM1
Router(config-if)# exit
```

Related Commands

Command	Description
ip rtp-header-compression	Enables Real-Time Transport Protocol (RTP) header compression on an interface.

police (percent)

To configure traffic policing on the basis of a percentage of bandwidth available on an interface, use the **police** command in policy-map class configuration mode. To remove traffic policing from the configuration, use the **no** form of this command.

police cir percent *percentage* [*burst-in-msec*] [**bc** *conform-burst-in-msec* **ms**] [**be** *peak-burst-in-msec* **ms**] [**pir percent** *percentage*] [**conform-action** *action* [**exceed-action** *action* [**violate-action** *action*]]]

no police cir percent *percentage* [*burst-in-msec*] [**bc** *conform-burst-in-msec* **ms**] [**be** *peak-burst-in-msec* **ms**] [**pir percent** *percentage*] [**conform-action** *action* [**exceed-action** *action* [**violate-action** *action*]]]

Syntax Description

cir	Committed information rate. Indicates that the CIR will be used for policing traffic.
percent	Specifies that a percentage of bandwidth will be used for calculating the CIR.
percentage	Specifies the bandwidth percentage. Valid range is a number from 1 to 100.
burst-in-msec	(Optional) Burst in milliseconds. Valid range is a number from 1 to 2000.
bc	(Optional) Conform burst (bc) size used by the first token bucket for policing traffic.
conform-burst-in-msec	(Optional) Specifies the bc value in milliseconds. Valid range is a number from 1 to 2000.
ms	(Optional) Indicates that the burst value is specified in milliseconds.
be	(Optional) Peak burst (be) size used by the second token bucket for policing traffic.
peak-burst-in-msec	(Optional) Specifies the be size in milliseconds. Valid range is a number from 1 to 2000.
pir	(Optional) Peak information rate. Indicates that the PIR will be used for policing traffic.
percent	(Optional) Specifies that a percentage of bandwidth will be used for calculating the PIR.
conform-action	(Optional) Action to take on packets whose rate is less than the conform burst. You must specify a value for peak-burst-in-msec before you specify the **conform-action**.
exceed-action	(Optional) Action to take on packets whose rate is within the conform and conform plus exceed burst.

violate-action	(Optional) Action to take on packets whose rate exceeds the conform plus exceed burst. You must specify the **exceed-action** before you specify the **violate-action**.
action	(Optional) Action to take on packets. Specify one of the following keywords: **All Supported Platforms** • **drop**—Drops the packet. • **set-clp-transmit**—Sets the ATM Cell Loss Priority (CLP) bit from 0 to 1 on the ATM cell and sends the packet with the ATM CLP bit set to 1. • **set-dscp-transmit** *new-dscp*—Sets the IP differentiated services code point (DSCP) value and sends the packet with the new IP DSCP value setting. • **set-frde-transmit**—Sets the Frame Relay discard eligible (DE) bit from 0 to 1 on the Frame Relay frame and sends the packet with the DE bit set to 1. • **set-prec-transmit** *new-prec*—Sets the IP precedence and sends the packet with the new IP precedence value setting. • **transmit**—Sends the packet with no alteration. **Supported Platforms Except the Cisco 10000 Series Router** • **policed-dscp-transmit**—(Exceed and violate action only). Changes the DSCP value per the policed DSCP map and sends the packet. • **set-cos-inner-transmit** *value*—Sets the inner class of service field as a policing action for a bridged frame on the Enhanced FlexWAN module, and when using bridging features on SPAs with the Cisco 7600 SIP-200 and Cisco 7600 SIP-400 on the Cisco 7600 series router. • **set-cos-transmit** value—Sets the packet cost of service (CoS) value and sends the packet. • **set-mpls-exposition-transmit**—Sets the Multiprotocol Label Switching (MPLS) experimental bits from 0 to 7 and sends the packet with the new MPLS experimental bit value setting. • **set-mpls-topmost-transmit**—Sets the MPLS experimental bits on the topmost label and sends the packet.

Command Default

All Supported Platforms

The default bc and be values are 4 ms.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.0(25)SX	The Percent-based Policing feature was introduced on the Cisco 10000 series router.
12.1(1)E	This command was integrated into Cisco IOS Release 12.2(1)E.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2(13)T	This command was modified for the Percentage-Based Policing and Shaping feature.
12.0(28)S	The command was integrated into Cisco IOS Release 12.0(28)S.
12.2(18)SXE	The command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(28)SB	The command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	The **set-cos-inner-transmit** keyword for the *action* argument was added when using multipoint bridging (MPB) features on the Enhanced FlexWAN module, and when using MPB on SPAs with the Cisco 7600 SIP-200 and Cisco 7600 SIP-400 on the Cisco 7600 series router.
12.2(31)SB2	Support was added on the PRE3 for the **set-frde-transmit** *action* argument for the Cisco 10000 series router.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command calculates the cir and pir on the basis of a percentage of the maximum amount of bandwidth available on the interface. When a policy map is attached to the interface, the equivalent cir and pir values in bits per second (bps) are calculated on the basis of the interface bandwidth and the percent value entered with this command. The **show policy-map interface** command can then be used to verify the bps rate calculated.

The calculated cir and pir bps rates must be in the range of 8000 and 2000000000 bps. If the rates are outside this range, the associated policy map cannot be attached to the interface. If the interface bandwidth changes (for example, more is added), the bps values of the cir and the pir are recalculated on the basis of the revised amount of bandwidth. If the cir and pir percentages are changed after the policy map is attached to the interface, the bps values of the cir and pir are recalculated.

Conform Burst and Peak Burst Sizes in Milliseconds

This command also allows you to specify the values for the conform burst size and the peak burst size in milliseconds. If you want bandwidth to be calculated as a percentage, the conform burst size and the peak burst size must be specified in milliseconds (ms).

Hierarchical Policy Maps

Policy maps can be configured in two-level (nested) hierarchies; a top (or “parent”) level and a secondary (or “child”) level. The **police** (percent) command can be configured for use in either a parent or child policy map.

Bandwidth and Hierarchical Policy Maps

The **police** (percent) command uses the maximum rate of bandwidth available as the reference point for calculating the bandwidth percentage. When the **police** (percent) command is configured in a child policy map, the **police** (percent) command uses the bandwidth amount specified in the next higher-level policy (in this case, the parent policy map). If the parent policy map does not specify the maximum bandwidth rate available, the **police** (percent) command uses the maximum bandwidth rate available on the next higher level (in this case, the physical interface, the highest point in the hierarchy) as the reference point. The **police** (percent) command always looks to the next higher level for the bandwidth reference point. The following sample configuration illustrates this point:

```
Policymap parent_policy
 class parent
  shape average 512000
  service-policy child_policy

Policymap child_policy
 class normal_type
  police cir percent 30
```

In this sample configuration, there are two hierarchical policies: one called parent_policy and one called child_policy. In the policy map called child_policy, the police command has been configured in the class called normal_type. In this class, the percentage specified by for the **police** (percent) command is 30 percent. The command will use 512 kbps, the peak rate, as the bandwidth reference point for class parent in the parent_policy. The **police** (percent) command will use 512 kbps as the basis for calculating the cir rate (512 kbps * 30 percent).

```
interface serial 4/0
 service-policy output parent_policy

Policymap parent_policy
 class parent
  bandwidth 512
  service-policy child_policy
```

In the above example, there is one policy map called parent_policy. In this policy map, a peak rate has not been specified. The **bandwidth** command has been used, but this command does not represent the maximum rate of bandwidth available. Therefore, the **police** (percent) command will look to the next higher level (in this case serial interface 4/0) to get the bandwidth reference point. Assuming the bandwidth of serial interface 4/0 is 1.5 Mbps, the **police** (percent) command will use 1.5 Mbps as the basis for calculating the cir rate (1500000 * 30 percent).

How Bandwidth Is Calculated

The **police** (percent) command is often used in conjunction with the **bandwidth** and **priority** commands. The **bandwidth** and **priority** commands can be used to calculate the total amount of bandwidth available on an entity (for example, a physical interface). When the **bandwidth** and **priority** commands calculate the total amount of bandwidth available on an entity, the following guidelines are invoked:

- If the entity is a physical interface, the total bandwidth is the bandwidth on the physical interface.
- If the entity is a shaped ATM permanent virtual circuit (PVC), the total bandwidth is calculated as follows:
  - For a variable bit rate (VBR) virtual circuit (VC), the sustained cell rate (SCR) is used in the calculation.
  - For an available bit rate (ABR) VC, the minimum cell rate (MCR) is used in the calculation.

For more information on bandwidth allocation, refer to the “Congestion Management Overview” chapter in the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Examples

The following example shows how to configure traffic policing using a CIR and a PIR on the basis of a percentage of bandwidth. In this example, a CIR of 20 percent and a PIR of 40 percent have been specified. Additionally, an optional bc value and be value (300 ms and 400 ms, respectively) have been specified.

```
Router> enable
Router# configure terminal
Router(config)# policy-map policy1
Router(config-pmap)# class class1
Router(config-pmap-c)# police cir percent 20 bc 300 ms be 400 ms pir percent 40
Router(config-pmap-c-police)# exit
```

After the policy map and class maps are configured, the policy map is attached to an interface as shown in the following example:

```
Router> enable
Router# configure terminal
Router(config)# interface serial4/0
Router(config-if)# service-policy input policy1
Router(config-if)# exit
```

Related Commands

Command	Description
bandwidth (policy-map class)	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
bridge-domain	Enables RFC 1483 ATM bridging or RFC 1490 Frame Relay bridging to map a bridged VLAN to an ATM PVC or Frame Relay DLCI.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
priority	Gives priority to a traffic class in a policy map.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
shape (percent)	Specifies average or peak rate traffic shaping on the basis of a percentage of bandwidth available on an interface.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.

police (policy map)

To create a per-interface policer and configure the policy-map class to use it, use the **police** command in policy-map class configuration mode. To delete the per-interface policer from the policy-map class, use the **no** form of this command.

police

police *bps* [[**bc**] *normal-burst-bytes* [*maximum-burst-bytes* | [**be**] [*burst-bytes*]]] [**pir** *bps* [**be** *burst-bytes*]] [**conform-action** *action* [**exceed-action** *action* [**violate-action** *action*]]]

no police *bps*

police cir

police cir *bps* [[**bc**] *normal-burst-bytes* [*maximum-burst-bytes* | [**be**] [*burst-bytes*]]] [**pir** *bps* [**be** *burst-bytes*]] [**conform-action** *action* [**exceed-action** *action* [**violate-action** *action*]]]

no police cir *bps*

Syntax Description

bps	The target bit rate in bits per second (bps). The postfix values **k**, **m**, and **g** are allowed, as is a decimal point. Valid range is from 8000 (or 8k) to 64000000000 (or 64g).
normal-burst-bytes	(Optional) The CIR token-bucket size in bytes for handling a burst. Valid range is from 1000 to 512000000.
maximum-burst-bytes	(Optional) The PIR token-bucket size in bytes for handling a burst. Valid range is from 1000 to 512000000.
burst-bytes	(Optional) The token-bucket size in bytes for handling a burst. Valid range is from 1000 to 512000000.
bc	(Optional) Specifies in bytes the allowed (conforming) burst size.
be	(Optional) Specifies in bytes the allowed excess burst size.
pir	(Optional) Specifies the peak information rate (PIR).
cir	Specifies the committed information rate (CIR).
conform-action *action*	(Optional) Specifies the action to take on packets that conform to the rate limit. See the "Usage Guidelines" section for valid values for the *action* argument.
exceed-action *action*	(Optional) Specifies the action to be taken on packets when the packet rate is greater than the rate specified in the *maximum-burst-bytes* argument. See the "Usage Guidelines" section for valid values for the *action* argument.
violate-action *action*	(Optional) Specifies the action to be taken when the packet rate is greater than the rate specified in the *maximum-burst-bytes* argument. See the "Usage Guidelines" section for valid values for the *action* argument.
aggregate *name*	Specifies a previously defined aggregate policer name and configures the policy-map class to use the specified aggregate policer.
percent *percent*	Specifies the percentage of the interface bandwidth to be allowed. Valid range is from 1 to 100.

burst	(Optional) The token-bucket size in milliseconds (ms) for handling a burst. Valid range is from 1 to 2000.
ms	Milliseconds. When bandwidth is specified as a percentage, this keyword must follow the *burst* argument.
flow	Specifies a microflow policer that will police each flow.
mask	Specifies the flow mask to be used for policing.
dest-only	Specifies the destination-only flow mask.
full-flow	Specifies the full-flow mask.
src-only	Specifies the source-only flow mask.

Command Default

No policing is performed.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.2(14)SX	This command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	This command was implemented on the Supervisor Engine 2 and integrated into Cisco IOS Release 12.2(17d)SXB.
12.2(17d)SXB3	The **police** *bps* minimum rate was lowered from 32,000 to 8,000 on FlexWAN interfaces only.
12.2(18)SXD	This command was changed as follows: • Added **set-mpls-exp-topmost-transmit** to the valid values for the **conform-action** keyword. • Changed the **set-mpls-exp-transmit** keyword to **set-mpls-exp-imposition-transmit**.
12.2(18)SXE	The *bps* maximum rate was increased from 4,000,000,000 to 10,000,000,000 bps to support 10-Gigabit Ethernet.
12.2(18)SXF	The CIR maximum rate was increased to 10,000,000,000 bps.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	The command behavior was changed so that if you modify only the police rate parameters and not the police actions, the police actions default to the default actions: conform-action transmit, exceed-action drop, and violate-action drop. This was implemented on the Cisco 10000 series router for the PRE3.
12.2(33)SB	The command behavior was changed so that if you modify only the police rate parameters and not the police actions, the police actions are preserved. This was implemented on the Cisco 10000 series router for the PRE3 and PRE4. For more information, see the “Usage Guidelines” section.
12.2(33)SXH2	The CIR maximum rate was increased to 64,000,000,000 bps.
12.2(33)SXI	The minimum CIR token bucket size was reduced to 1 byte.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

In Cisco IOS Release 12.2(17d)SXB3, valid values for the *bps* argument for the FlexWAN interfaces only are from 8,000 to 4,000,000,000 bps.

Use the **mls qos aggregate-policer** *name* command to create a named aggregate policer.

You can create two types of aggregate policers: named and per-interface. Both types can be attached to more than one port as follows:

- You create named aggregate policers using the **mls qos aggregate-policer** command. If you attach a named aggregate policer to multiple ingress ports, it polices the matched traffic from all the ingress ports to which it is attached.
- You define per-interface aggregate policers in a policy-map class using the **police** command. If you attach a per-interface aggregate policer to multiple ingress ports, it polices the matched traffic on each ingress port separately.

Use the **no police aggregate** *name* command to clear the use of the named aggregate policer.

Enter the **police flow** command to define a microflow policer (you cannot apply microflow policing to ARP traffic).

Enter the **police** command to define per-interface (not named) aggregate policers.

If the traffic is both aggregate and microflow policed, the aggregate and the microflow policers must both be in the same policy-map class and each must use the same **conform-action** and **exceed-action** keywords.

Values for the action Argument

The valid values for the *action* argument are as follows:

- **drop**—Drops packets that do not exceed the rate set for the *bps* argument.
- **set-clp-transmit**—Sets and sends the ATM cell loss priority (CLP).
- **set-cos-inner-transmit** {*new-cos*}—Marks the matched traffic with a new inner class of service (CoS) value of the *new-cos* argument. Valid values of the *new-cos* argument are from 0 to 7.
- **set-cos-transmit** {*new-cos*}—Marks the matched traffic with a new CoS value of the *new-cos* argument. Valid values of the *new-cos* argument are from 0 to 7.
- **set-cos-transmit**—Sets and sends the ATM cell loss priority (CLP).
- **set-dscp-transmit** {*dscp-bit-pattern* | *dscp-value* | **default** | **ef**}—Marks the matched traffic with a new DSCP value:
  - *dscp-bit-pattern*—Specifies a DSCP bit pattern. Valid values are listed in Table 1-5.
  - *dscp-value*—Specifies a DSCP value. Valid values are from 0 to 63.
  - **default**—Matches packets with the default DSCP value (000000).
  - **ef**—Matches packets with the Expedited Forwarding (EF) per-hop behavior (PHB) DSCP value (101110).

Table 1-5 Valid DSCP Bit Pattern Values

Keyword	Definition
af11	Matches packets with AF11 DSCP (001010).
af12	Matches packets with AF12 DSCP (001100).
af13	Matches packets with AF13 DSCP (001110).
af21	Matches packets with AF21 DSCP (010010).
af22	Matches packets with AF22 DSCP (010100).
af23	Matches packets with AF23 DSCP (010110).
af31	Matches packets with AF31 DSCP (011010).
af32	Matches packets with AF32 DSCP (011100).
af33	Matches packets with AF33 DSCP (011110).
af41	Matches packets with AF41 DSCP (100010).
af42	Matches packets with AF42 DSCP (100100).
af43	Matches packets with AF43 DSCP (100110).
cs1	Matches packets with CS1 (precedence 1) DSCP (001000).
cs2	Matches packets with CS2 (precedence 2) DSCP (010000).
cs3	Matches packets with CS3 (precedence 3) DSCP (011000).
cs4	Matches packets with CS4 (precedence 4) DSCP (100000).
cs5	Matches packets with CS5 (precedence 5) DSCP (101000).
cs6	Matches packets with CS6 (precedence 6) DSCP (110000).
cs7	Matches packets with CS7 (precedence 7) DSCP (111000).

- **set-frde-transmit**—Sets and sends the Frame Relay discard eligible (FR DE) bit. This is valid for the **exceed-action** *action keyword and argument combination***.**
- **set-mpls-exp-imposition-transmit** *new-mpls-exp*—Rewrites the Multiprotocol Label Switching (MPLS) experimental (exp) bits on imposed label entries and transmits the bits. The *new-mpls-exp* argument specifies the value used to set the MPLS EXP bits that are defined by the policy map. Valid values for the *new-mpls-exp* argument are from 0 to 7.
- **set-mpls-exp-topmost-transmit**—Sets experimental bits on the topmost label and sends the packet.

Note The **set-mpls-exp-topmost-transmit** keyword is not supported in some releases of the Catalyst 6500 series switch or the Cisco 7600 series router.

- **set-prec-transmit** *new-precedence [***exceed-action***]*—Marks the matched traffic with a new IP-precedence value and transmits it. Valid values for the *new-precedence* argument are from 0 to 7. You can also follow this action with the **exceed-action** keyword.
- **set-qos-transmit**—Rewrites qos-group and sends the packet.
- **transmit**—Transmits the packets that do not exceed the rate set for the *bps* argument. The optional keyword and argument combination for the **transmit** keyword is **exceed-action** *action*.

If the following keywords are not specified, the default actions are as follows:

- **conform-action** is **transmit**.
- **exceed-action** is **drop**.
- **violate-action** is **drop**.

This example shows how to specify a previously defined aggregate-policer name and configure the policy-map class to use the specified aggregate policer:

```
Router(config-pmap-c)# police aggregate agg1
```

This example shows how to create a policy map named police-setting that uses the class map access-match, which is configured to trust received IP-precedence values and is configured with a maximum-capacity aggregate policer and a microflow policer:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# policy-map police-setting
Router(config-pmap)# class access-match
Router(config-pmap-c)# trust ip-precedence
Router(config-pmap-c)# police 1000000000 200000 conform-action set-prec-transmit 6
exceed-action policed-dscp-transmit
Router(config-pmap-c)# police flow 10000000 10000 conform-action set-prec-transmit 6
exceed-action policed-dscp-transmit
Router(config-pmap-c)# exit
```

Related Commands

Command	Description
class-map	Accesses QoS class-map configuration mode to configure QoS class maps.
mls qos aggregate-policer	Defines a named aggregate policer for use in policy maps.
police	Configures traffic policing in QoS policy-map class configuration mode or QoS policy-map class police configuration mode.
service-policy	Attaches a policy map to an interface.
show class-map	Displays class-map information.
show policy-map	Displays information about the policy map.
show policy-map interface	Displays the statistics and the configurations of the input and output policies that are attached to an interface.

police (two rates)

To configure traffic policing using two rates, the committed information rate (CIR) and the peak information rate (PIR), use the **police** command in policy-map class configuration mode. To remove two-rate traffic policing from the configuration, use the **no** form of this command.

police cir *cir* [**bc** *conform-burst*] *[***pir** *pir]* [**be** *peak-burst*] [**conform-action** *action* [**exceed-action** *action* [**violate-action** *action*]]]

no police cir

Syntax Description

cir	Committed information rate (CIR) at which the first token bucket is updated.
cir	Specifies the CIR value in bits per second. The value is a number from 8000 to 200000000.
bc	(Optional) Conform burst (bc) size used by the first token bucket for policing.
conform-burst	(Optional) Specifies the bc value in bytes. The value is a number from 1000 to 51200000.
pir	(Optional) Peak information rate (PIR) at which the second token bucket is updated.
pir	(Optional) Specifies the PIR value in bits per second. The value is a number from 8000 to 200000000.
be	(Optional) Peak burst (be) size used by the second token bucket for policing.
peak-burst	(Optional) Specifies the peak burst (be) size in bytes. The size varies according to the interface and platform in use.
conform-action	(Optional) Action to take on packets that conform to the CIR and PIR.
exceed-action	(Optional) Action to take on packets that conform to the PIR but not the CIR.

violate-action	(Optional) Action to take on packets exceed the PIR.
action	(Optional) Action to take on packets. Specify one of the following keywords: • **drop**—Drops the packet. • **set-clp-transmit**—Sets the ATM Cell Loss Priority (CLP) bit from 0 to 1 on the ATM cell and sends the packet with the ATM CLP bit set to 1. • **set-cos-inner-transmit** *value*—Sets the inner class of service field as a policing action for a bridged frame on the Enhanced FlexWAN module, and when using bridging features on SPAs with the Cisco 7600 SIP-200 and Cisco 7600 SIP-400 on the Cisco 7600 series router. • **set-dscp-transmit** *new-dscp*—Sets the IP differentiated services code point (DSCP) value and sends the packet with the new IP DSCP value setting. • **set-dscp-tunnel-transmit** *value*—Sets the DSCP value (0 to 63) in the tunnel header of a Layer 2 Tunnel Protocol Version 3 (L2TPv3) or Generic Routing Encapsulation (GRE) tunneled packet for tunnel marking and transmits the packet with the new value. • **set-frde-transmit**—Sets the Frame Relay discard eligible (DE) bit from 0 to 1 on the Frame Relay frame and sends the packet with the DE bit set to 1. • **set-mpls-exp-transmit**—Sets the Multiprotocol Label Switching (MPLS) experimental bits from 0 to 7 and sends the packet with the new MPLS experimental bit value setting. • **set-prec-transmit** *new-prec*—Sets the IP precedence and sends the packet with the new IP precedence value setting. • **set-prec-tunnel-transmit** *value*—Sets the precedence value (0 to 7) in the tunnel header of an L2TPv3 or GRE tunneled packet for tunnel marking and transmits the packet with the new value. • **set-qos-transmit** *new-qos*—Sets the quality of service (QoS) group value and sends the packet with the new QoS group value setting. • **transmit**—Sends the packet with no alteration.

Command Default

Traffic policing using two rates is disabled.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T. The **violate-action** keyword was added.

Release	Modification
12.2(2)T	The following keywords for the *action* argument were added: • **set-clp-transmit** • **set-frde-transmi**t • **set-mpls-exp-transmit**
12.2(4)T	This command expanded for the Two-Rate Policing feature. The **cir** and **pir** keywords were added to accommodate two-rate traffic policing.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB, and the **set-dscp-tunnel-transmit** and **set-prec-tunnel-transmit** keywords for the *action* argument were added. These keywords are intended for marking Layer 2 Tunnel Protocol Version 3 (L2TPv3) tunneled packets.
12.2(33)SRA	The **set-cos-inner-transmit** keyword for the *action* argument was added when using multipoint bridging (MPB) features on the Enhanced FlexWAN module, and when using MPB on SPAs with the Cisco 7600 SIP-200 and Cisco 7600 SIP-400 on the Cisco 7600 series router.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(33)SRC	This command was modified to support the Cisco 7600 series router equipped with a Cisco Multilayer Switch Feature Card 3 (MSFC3).
12.4(15)T2	This command was modified to include support for marking Generic Routing Encapsulation (GRE) tunneled packets. **Note** For this release, marking GRE-tunneled packets is supported only on platforms equipped with a Cisco MGX Route Processor Module (RPM-XF).
12.2(33)SB	This command was modified to include support for marking GRE-tunneled packets, and support for the Cisco 7300 series router was added.
12.4(20)T	Support was added for hierarchical queueing framework (HQF) using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Configuring Priority with an Explicit Policing Rate

When you configure a priority class with an explicit policing rate, traffic is limited to the policer rate regardless of congestion conditions. In other words, even if bandwidth is available, the priority traffic cannot exceed the rate specified with the explicit policer.

Token Buckets

Two-rate traffic policing uses two token buckets—Tc and Tp—for policing traffic at two independent rates. Note the following points about the two token buckets:

- The Tc token bucket is updated at the CIR value each time a packet arrives at the two-rate policer. The Tc token bucket can contain up to the confirm burst (Bc) value.
- The Tp token bucket is updated at the PIR value each time a packet arrives at the two-rate policer. The Tp token bucket can contain up to the peak burst (Be) value.

Updating Token Buckets

The following scenario illustrates how the token buckets are updated:

A packet of B bytes arrives at time t. The last packet arrived at time t1. The CIR and the PIR token buckets at time t are represented by Tc(t) and Tp(t), respectively. Using these values and in this scenario, the token buckets are updated as follows:

Tc(t) = min(CIR * (t-t1) + Tc(t1), Bc)

Tp(t) = min(PIR * (t-t1) + Tp(t1), Be)

Marking Traffic

The two-rate policer marks packets as either conforming, exceeding, or violating a specified rate. The following points (using a packet of B bytes) illustrate how a packet is marked:

- If B > Tp(t), the packet is marked as violating the specified rate.
- If B > Tc(t), the packet is marked as exceeding the specified rate, and the Tp(t) token bucket is updated as Tp(t) = Tp(t) – B.

Otherwise, the packet is marked as conforming to the specified rate, and both token buckets—Tc(t) and Tp(t)—are updated as follows:

Tp(t) = Tp(t) – B

Tc(t) = Tc(t) – B

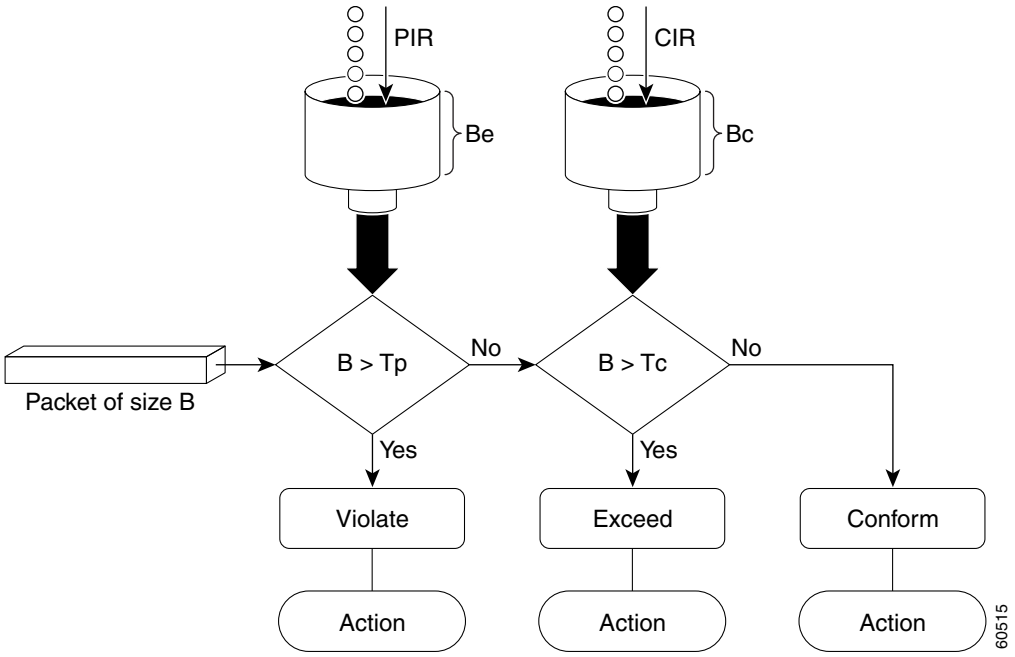
For example, if the CIR is 100 kbps, the PIR is 200 kbps, and a data stream with a rate of 250 kbps arrives at the two-rate policer, the packet would be marked as follows:

- 100 kbps would be marked as conforming to the rate.
- 100 kbps would be marked as exceeding the rate.
- 50 kbps would be marked as violating the rate.

Marking Packets and Assigning Actions Flowchart

The flowchart in Figure 1-1 illustrates how the two-rate policer marks packets and assigns a corresponding action (that is, violate, exceed, or conform) to the packet.

Figure 1-1 Marking Packets and Assigning Actions with the Two-Rate Policer



Examples

Setting Priority with an Explicit Policing Rate

In the following example, priority traffic is limited to a committed rate of 1000 kbps regardless of congestion conditions in the network:

```
Router(config)# policy-map p1
Router(config-pmap)# class c1
Router(config-pmap-c)# police cir 1000000 conform-action transmit exceed-action drop
```

Two-Rate Policing

In the following example, two-rate traffic policing is configured on a class to limit traffic to an average committed rate of 500 kbps and a peak rate of 1 Mbps:

```
Router(config)# class-map police
Router(config-cmap)# match access-group 101
Router(config-cmap)# policy-map policy1
Router(config-pmap)# class police
Router(config-pmap-c)# police cir 500000 bc 10000 pir 1000000 be 10000 conform-action
transmit exceed-action set-prec-transmit 2 violate-action drop
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface serial0/1
Router(config-if)# service-policy output policy1
Router(config-if)# end
Router# show policy-map policy1

 Policy Map policy1
  Class police
   police cir 500000 conform-burst 10000 pir 1000000 peak-burst 10000 conform-action
transmit exceed-action set-prec-transmit 2 violate-action drop
```

Traffic marked as conforming to the average committed rate (500 kbps) will be sent as is. Traffic marked as exceeding 500 kbps, but not exceeding 1 Mbps, will be marked with IP Precedence 2 and then sent. All traffic marked as exceeding 1 Mbps will be dropped. The burst parameters are set to 10000 bytes.

In the following example, 1.25 Mbps of traffic is sent ("offered") to a policer class:

```
Router# show policy-map interface serial3/0

 Serial3/0

  Service-policy output: policy1

   Class-map: police (match all)
    148803 packets, 36605538 bytes
    30 second offered rate 1249000 bps, drop rate 249000 bps
    Match: access-group 101
    police:
     cir 500000 bps, conform-burst 10000, pir 1000000, peak-burst 100000
     conformed 59538 packets, 14646348 bytes; action: transmit
     exceeded 59538 packets, 14646348 bytes; action: set-prec-transmit 2
     violated 29731 packets, 7313826 bytes; action: drop
     conformed 499000 bps, exceed 500000 bps violate 249000 bps

   Class-map: class-default (match-any)
    19 packets, 1990 bytes
    30 seconds offered rate 0 bps, drop rate 0 bps
    Match: any
```

The two-rate policer marks 500 kbps of traffic as conforming, 500 kbps of traffic as exceeding, and 250 kbps of traffic as violating the specified rate. Packets marked as conforming to the rate will be sent as is, and packets marked as exceeding the rate will be marked with IP Precedence 2 and then sent. Packets marked as violating the rate are dropped.

Related Commands

Command	Description
police	Configures traffic policing.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or an output interface to be used as the service policy for that interface.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.

police rate (control-plane)

To configure traffic policing for traffic that is destined for the control plane, use the **police rate** command in QoS policy-map class configuration mode. To remove traffic policing from the configuration, use the **no** form of this command.

police rate *units* **pps** [**burst** *burst-in-packets* **packets**] [**peak-rate** *peak-rate-in-pps* **pps**] [**peak-burst** *peak-burst-in-packets* **packets**] [**conform-action** *action*]

no police rate *units* **pps** [**burst** *burst-in-packets* **packets**] [**peak-rate** *peak-rate-in-pps* **pps**] [**peak-burst** *peak-burst-in-packets* **packets**] [**conform-action** *action*]

Syntax for Percent

police rate percent *percentage* [**burst** *ms* **ms**] [**peak-rate percent** *percentage*] [**peak-burst** *ms* **ms**]

no police rate percent *percentage* [**burst** *ms* **ms**] [**peak-rate percent** *percentage*] [**peak-burst** *ms* **ms**]

Syntax Description

units	Specifies the police rate. If the police rate is specified in pps, the valid range of values is 1 to 2000000 pps. If the police rate is specified in bps, the valid range of values is 8000 to 20000000000.
pps	Specifies that packets per seconds (pps) will be used to determine the rate at which traffic is policed.
burst *burst-in-packets* **packets**	(Optional) Specifies the burst rate, in packets, will be used for policing traffic. Valid range of values is 1 to 512000.
peak-rate *peak-rate-in-pps* **pps**	(Optional) Specifies the peak information rate (PIR) will be used for policing traffic and calculating the PIR. Valid range of values is 1 to 512000.
peak-burst *peak-burst-in-packets* **packets**	(Optional) Specifies the peak burst value, in packets, will be used for policing traffic. Valid range of values is 1 to 512000.
bps	(Optional) Specifies that bits per second (bps) will be used to determine the rate at which traffic is policed.
burst *burst-in-bytes* **bytes**	(Optional) Specifies the burst rate, in bytes, will be used for policing traffic. Valid range is from 1000 to 512000000.
peak-rate *peak-rate-in-bps* **bps**	(Optional) Specifies the peak burst value, in bytes, for the peak rate. Valid range is from 1000 to 512000000.
peak-burst *peak-burst-in-bytes* **bytes**	(Optional) Specifies the peak burst value, in bytes, will be used for policing traffic. Valid range is from 1000 to 512000000.
percent	A percentage of interface bandwidth will be used to determine the rate at which traffic is policed.
percentage	Specifies the bandwidth percentage. Valid range is from 1 to 100.
burst *ms* **ms**	(Optional) Specifies the burst rate, in milliseconds, will be used for policing traffic. Valid range is from 1 to 2000.
peak-rate percent *percentage*	(Optional) Specifies a percentage of interface bandwidth will be used to determine the PIR. Valid range is from 1 to 100.

peak-burst *ms* **ms**	(Optional) Specifies the peak burst rate, in milliseconds, will be used for policing traffic. Valid range is from 1 to 2000.
conform-action *action*	(Optional) Specifies the action to take on packets that conform to the police rate limit. See the "Usage Guidelines" section for the actions you can specify.
exceed-action *action*	(Optional) Specifies the action to take on packets that exceed the rate limit. See the "Usage Guidelines" section for the actions you can specify.
violate-action *action*	(Optional) Specifies the action to take on packets that continuously exceed the police rate limit. See the "Usage Guidelines" section for the actions you can specify.

Command Default

Disabled

Command Modes

QoS policy-map class configuration

Command History

Release	Modification
12.3(7)T	This command was introduced.
12.2(18)SXD1	Support for this command was introduced on the Supervisor Engine 720.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2 and implemented on the Cisco 10000 series router.
12.3(7)T	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **police rate** command to limit traffic that is destined for the control plane on the basis of packets per second (pps), bytes per seconds (bps), or a percentage of interface bandwidth.

If the **police rate** command is issued, but the a rate is not specified, traffic that is destined for the control plane will be policed on the basis of bps.

Table 1-6 lists the actions you can specify for the *action* argument.

Table 1-6 action Argument Values

Action	Description
drop	Drops the packet. This is the default action for traffic that exceeds or violates the committed police rate.
set-clp-transmit *value*	Sets the ATM Cell Loss Priority (CLP) bit on the ATM cell. Valid values are 0 or 1.

Table 1-6 action Argument Values (continued)

Action	Description
set-discard-class-transmit *value*	Sets the discard class attribute of a packet and transmits the packet with the new discard class setting. Valid values are from 0 to 7.
set-dscp-transmit *value*	Sets the IP differentiated services code point (DSCP) value and transmits the packet with the new IP DSCP value setting. Valid values are from 0 to 63.
set-dscp-tunnel-transmit *value*	Rewrites the tunnel packet DSCP and transmits the packet with the new tunnel DSCP value. Valid values are from 0 to 63.
set-frde-transmit *value*	Sets the Frame Relay Discard Eligibility (DE) bit from 0 to 1 on the Frame Relay frame and transmits the packet with the DE bit set to 1.
set-mpls-exp-imposition-transmit *value*	Sets the Multiprotocol Label Switching (MPLS) experimental (EXP) bits in the imposed label headers and transmits the packet with the new MPLS EXP bit value setting. Valid values are from 0 to 7.
set-mpls-exp-transmit *value*	Sets the MPLS EXP field value in the MPLS label header at the input interface, output interface, or both. Valid values are from 0 to 7.
set-prec-transmit *value*	Sets the IP precedence and transmits the packet with the new IP precedence value. Valid values are from 0 to 7.
set-prec-tunnel-transmit *value*	Sets the tunnel packet IP precedence and transmits the packet with the new IP precedence value. Valid values are from 0 to 7.
set-qos-transmit *value*	Sets the QoS group and transmits the packet with the new QoS group value. Valid values are from 0 to 63.
transmit	Transmits the packet. The packet is not altered.

Examples

The following example shows how to configure the action to take on packets that conform to the police rate limit:

```
Router(config)# access-list 140 deny tcp host 10.1.1.1 any eq telnet
Router(config)# access-list 140 deny tcp host 10.1.1.2 any eq telnet
Router(config)# access-list 140 permit tcp any any eq telnet
Router(config)# class-map match-any pps-1
Router(config-cmap)# match access-group 140
Router(config-cmap)# exit
Router(config)# policy-map copp-pps
Router(config-pmap)# class pps-1
Router(config-pmap)# police rate 10000 pps burst 100 packets peak-rate 10100 pps
peak-burst 150 packets conform-action transmit
Router(config-cmap)# exit
Router(config)# control-plane
Router(config-cp)# service-policy input copp-pps
Router(config-cp)# exit
```

Related Commands

Command	Description
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.

policy-map

To enter policy-map configuration mode and create or modify a policy map that can be attached to one or more interfaces to specify a service policy, use the **policy-map** command in global configuration mode. To delete a policy map, use the **no** form of this command.

policy-map [**type** {**control** | **service**}] *policy-map-name*

no policy-map [**type** {**control** | **traffic**}] *policy-map-name*

Syntax Description

type	Specifies the policy-map type.
control	(Optional) Creates a control policy map.
service	(Optional) Creates a service policy map.
policy-map-name	Name of the policy map. The name can be a maximum of 40 alphanumeric characters.

Command Default

The policy map is not configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.4(4)T	The **type access-control** keywords were added to support flexible packet matching. The **type port-filter** and **type queue-threshold** keywords were added to support control-plane protection.
12.4(6)T	The **type logging** keywords were added to support control-plane packet logging.
12.2(31)SB	The **type control** and **type service** keywords were added to support the Cisco 10000 series router.
12.2(18)ZY	The following modifications were made to the **policy-map** command: • The **type access-control** keywords were integrated into Cisco IOS Release 12.2(18)ZY on the Catalyst 6500 series switch that is equipped with the Supervisor 32/programmable intelligent services accelerator (PISA) engine. • The command was modified to enhance Network-Based Application Recognition (NBAR) functionality on the Catalyst 6500 series switch that is equipped with the Supervisor 32/PISA engine.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(33)SRC	Support for this command was implemented on Cisco 7600 series routers.

Release	Modification
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release only supports the **type control** and **type service** keywords.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release only supports the **type control** and **type service** keywords.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **policy-map** command to specify the name of the policy map to be created, added to, or modified before you configure policies for classes whose match criteria are defined in a class map. The **policy-map** command enters policy-map configuration mode, in which you can configure or modify the class policies for a policy map.

You can configure class policies in a policy map only if the classes have match criteria defined for them. Use the **class-map** and **match** commands to configure the match criteria for a class. Because you can configure a maximum of 64 class maps, a policy map cannot contain more than 64 class policies.

A single policy map can be attached to more than one interface concurrently. Except as noted, when you attempt to attach a policy map to an interface, the attempt is denied if the available bandwidth on the interface cannot accommodate the total bandwidth requested by class policies that make up the policy map. In this case, if the policy map is already attached to other interfaces, it is removed from them.

Whenever you modify class policy in an attached policy map, class-based weighted fair queueing (CBWFQ) is notified and the new classes are installed as part of the policy map in the CBWFQ system.

Note Policy-map installation via subscriber-profile is not supported. If you configure an unsupported policy map and there are a large number of sessions, then an equally large number of messages print on the console. For example, if there are 32,000 sessions, then 32,000 messages print on the console at 9,600 baud.

Examples

The following example creates a policy map called “policy1” and configures two class policies included in that policy map. The class policy called “class1” specifies policy for traffic that matches access control list (ACL) 136. The second class is the default class to which packets that do not satisfy configured match criteria are directed.

```
! The following commands create class-map class1 and define its match criteria:
class-map class1
 match access-group 136

! The following commands create the policy map, which is defined to contain policy
! specification for class1 and the default class:
policy-map policy1

class class1
 bandwidth 2000
 queue-limit 40

class class-default
 fair-queue 16
 queue-limit 20
```

The following example creates a policy map called “policy9” and configures three class policies to belong to that map. Of these classes, two specify policy for classes with class maps that specify match criteria based on either a numbered ACL or an interface name, and one specifies policy for the default class called “class-default” to which packets that do not satisfy configured match criteria are directed.

```
policy-map policy9

class acl136
 bandwidth 2000
 queue-limit 40

class ethernet101
 bandwidth 3000
 queue-limit 30

class class-default
 fair-queue 10
 queue-limit 20
```

preferred-path

Specifies the preferred path within an MPLS pseudowire-class where multiple paths exist. To remove a preferred path, use the **no** form of this command.

preferred-path {[interface] tunnel *tunnel***] | peer** *peer***} disable-fallback**

no **preferred-path {[interface] tunnel** *tunnel***] | peer** *peer***} disable-fallback**

Syntax Description

interface	Specifies the preferred path using an output interface.
tunnel	Specifies a tunnel interface.
tunnel	The tunnel interface number.
peer	Specifies the preferred path using a peer host name or IP address.
peer	The peer host name or IP address.
disable-fallback	Specifies that pseudowire class traffic cannot use an alternate route.

Command Default

This command is disabled by default.

Command Modes

Pseudowire class configuration

Command History

Release	Modification
12.0(25)S	This command was introduced.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example creates a pseudowire class called pw_tun2, specifies MPLS encapsulation, and specifies a preferred path with fallback disabled.

```
Router# configure terminal
Router(config)# pseudowire-class pw_tun2
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# preferred-path peer 50.0.0.2 disable-fallback
```

priority

To give priority to a class of traffic belonging to a policy map, use the **priority** command in policy-map class configuration mode. To remove a previously specified priority for a class, use the **no** form of this command.

priority {*bandwidth-kbps* | **percent** *percentage*} [*burst*]

no priority {*bandwidth-kbps* | **percent** *percentage*} [*burst*]

Syntax Description

bandwidth-kbps	Guaranteed allowed bandwidth, in kbps, for the priority traffic. The amount of guaranteed bandwidth varies according to the interface and platform in use. Beyond the guaranteed bandwidth, the priority traffic will be dropped in the event of congestion to ensure that the nonpriority traffic is not starved.
percent	Specifies that the amount of guaranteed bandwidth will be specified by the percent of available bandwidth.
percentage	Used in conjunction with the **percent** keyword, specifies the percentage of the total available bandwidth to be set aside for the priority class. The percentage can be a number from 1 to 100.
burst	(Optional) Specifies the burst size in bytes. The burst size configures the network to accommodate temporary bursts of traffic. The default burst value, which is computed as 200 milliseconds of traffic at the configured bandwidth rate, is used when the burst argument is not specified. The range of the burst is from 32 to 2000000 bytes.

Command Default

No priority is set.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(7)T	This command was introduced.
12.0(5)XE5	This command was introduced for the Versatile Interface Processor (VIP) as part of the Distributed Low Latency Queueing (Low Latency Queueing for the VIP) feature.
12.0(9)S	This command was introduced for the VIP as part of the Distributed Low Latency Queueing (Low Latency Queueing for the VIP) feature.
12.1(2)E	The *burst* argument was added.
12.1(3)T	The *burst* argument was integrated in Release 12.1(3)T.
12.1(5)T	This command was introduced for the VIP as part of the Distributed Low Latency Queueing (Low Latency Queueing for the VIP) feature.
12.2(2)T	The **percent** keyword and the *percentage* argument were added.

Release	Modification
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command configures low latency queueing (LLQ), providing strict priority queueing (PQ) for class-based weighted fair queueing (CBWFQ). Strict PQ allows delay-sensitive data such as voice to be dequeued and sent before packets in other queues are dequeued.

The **priority** command allows you to set up classes based on a variety of criteria (not just User Datagram Ports (UDP) ports) and assign priority to them, and is available for use on serial interfaces and ATM permanent virtual circuits (PVCs). A similar command, the **ip rtp priority** command, allows you to stipulate priority flows based only on UDP port numbers and is not available for ATM PVCs.

When the device is not congested, the priority class traffic is allowed to exceed its allocated bandwidth. When the device is congested, the priority class traffic above the allocated bandwidth is discarded.

The **bandwidth** and **priority** commands cannot be used in the same class, within the same policy map. These commands can be used together in the same policy map, however.

Within a policy map, you can give one or more classes priority status. When multiple classes within a single policy map are configured as priority classes, all traffic from these classes is queued to the same, single, priority queue.

When the policy map containing class policy configurations is attached to the interface to stipulate the service policy for that interface, available bandwidth is assessed. If a policy map cannot be attached to a particular interface because of insufficient interface bandwidth, the policy is removed from all interfaces to which it was successfully attached.

For more information on bandwidth allocation, see the chapter "Congestion Management Overview" in the *Cisco IOS Quality of Service Solutions Configuration Guide.*

Examples

The following example configures PQ with a guaranteed bandwidth of 50 kbps and a one-time allowable burst size of 60 bytes for the policy map called policy1:

```
Router(config)# policy-map policy1
Router(config-pmap)# class voice
Router(config-pmap-c)# priority 50 60
```

In the following example, 10 percent of the available bandwidth is reserved for the class called voice on interfaces to which the policy map called policy1 has been attached:

```
Router(config)# policy-map policy1
Router(config-pmap)# class voice
Router(config-pmap-c)# priority percent 10
```

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
ip rtp priority	Reserves a strict priority queue for a set of RTP packet flows belonging to a range of UDP destination ports.
ip rtp reserve	Reserves a special queue for a set of RTP packet flows belonging to a range of UDP destination ports.
max-reserved-bandwidth	Changes the percent of interface bandwidth allocated for CBWFQ, LLQ, and IP RTP Priority.
show interfaces fair-queue	Displays information and statistics about WFQ for a VIP-based interface.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.
show queue	Displays the contents of packets inside a queue for a particular interface or VC.

private-vlan synchronize

To map the secondary VLANs to the same instance as the primary VLAN, use the **private-vlan synchronize** command in MST configuration submode.

private-vlan synchronize

Syntax Description

This command has no arguments or keywords.

Defaults

The secondary VLANs are not mapped to the same instance as the primary VLAN.

Command Modes

MST configuration (config-mst)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If you do not map VLANs to the same instance as the associated primary VLAN when you exit the Multiple Spanning Tree (802.1s) (MST) configuration submode, a warning message displays and lists the secondary VLANs that are not mapped to the same instance as the associated primary VLAN. The **private-vlan synchronize** command automatically maps all secondary VLANs to the same instance as the associated primary VLANs.

Examples

This example assumes that a primary VLAN 2 and a secondary VLAN 3 are associated to VLAN 2, and that all VLANs are mapped to the Common and Internal Spanning Tree (CIST) instance 1. This example also shows the output if you try to change the mapping for the primary VLAN 2 only:

```
Router(config)# spanning-tree mst configuration
Router(config-mst)# instance 1 vlan 2
Router(config-mst)# exit

These secondary vlans are not mapped to the same instance as their primary:
-> 3
```

This example shows how to initialize private VLAN (PVLAN) synchronization:

```
Router(config-mst)# private-vlan synchronize
Router(config-mst)#
```

Related Commands

Command	Description
show	Verifies the MST configuration.
show spanning-tree mst	Displays information about the MST protocol.

protocol (ATM)

To configure a static map for an ATM permanent virtual circuit (PVC), switched virtual circuit (SVC), or virtual circuit (VC) class or to enable Inverse Address Resolution Protocol (ARP) or Inverse ARP broadcasts on an ATM PVC, use the **protocol** command in the appropriate mode. To remove a static map or disable Inverse ARP, use the **no** form of this command.

protocol *protocol* {*protocol-address* [**virtual-template**] | **inarp**} [[**no**] **broadcast** | **disable-check-subnet** | [**no**] **enable-check-subnet**]

no protocol *protocol* {*protocol-address* [**virtual-template**] | **inarp**} [[**no**] **broadcast** **disable-check-subnet** | [**no**] **enable-check-subnet**]

Syntax Description

protocol	Choose one of the following values: • **arp**—IP ARP • **bridge**—bridging • **cdp**—Cisco Discovery Protocol • **clns**—ISO Connectionless Network Service (CLNS) • **clns_es**—ISO CLNS end system • **clns_is**—ISO CLNS intermediate system • **cmns**—ISO CMNS • **compressedtcp**—Compressed TCP • **ip**—IP • **ipv6**—IPV6 • **llc2**—llc2 • **pad**—packet assembler/disassembler (PAD) links • **ppp**—Point-to-Point Protocol carried on the VC • **pppoe**—PPP over Ethernet • **pppovlan**—PPPoE over vlan • **rsrb**—remote source-route bridging • **snapshot**—snapshot routing support
protocol-address	Destination address that is being mapped to a PVC.
virtual-template	(Optional) Specifies parameters that the point-to-point protocol over ATM (PPPoA) sessions will use. **Note** This keyword is valid only for the PPP protocol.

inarp	Enables Inverse ARP on an ATM PVC. If you specify a protocol address instead of **inarp**, Inverse ARP is automatically disabled for that protocol.
[**no**] **broadcast**	(Optional) **I**ndicates that this map entry is used when the corresponding protocol sends broadcast packets to the interface. Pseudobroadcasting is supported. The **broadcast** keyword of the **protocol** command takes precedence if you previously configured the **broadcast** command on the ATM PVC or SVC.
disable-check-subnet	(Optional) Disables subnet checking for InARP.
enable-check-subnet	(Optional) Enables subnet checking for InARP.

Inverse ARP is enabled for IP if the protocol is running on the interface and no static map is configured. Subnet checking for InARP is disabled by default.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC or SVC)
PVC-in-range configuration (for an individual PVC within a PVC range)
PVC range configuration (for an ATM PVC range)
VC-class configuration (for a VC class)

Command History

Release	Modification
11.3	This command was introduced.
12.1	The **ppp** and **virtual-template** keywords were added.
12.1(5)T	The **ip** and **ipx** options were made available in PVC range and PVC-in-range configuration modes.
12.2(13)T	The **apollo**, **vines**, and **xns** keywords were removed because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer supported in the Cisco IOS software.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2SRE	The **disable-check-subnet** and **enable-check-subnet** keywords were added.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Command Application

Use this command to perform either of the following tasks:

- Configure a static map for an ATM PVC, SVC, or VC class.
- Enable Inverse ARP or Inverse ARP broadcasts on an ATM PVC or PVC range by configuring Inverse ARP directly on the PVC, in the PVC range, or in a VC class (applies to IP protocol only).
- Enable the router to respond to an InARP request when the source IP address contained in the request is not in the subnet as the receiving sub-interface on which PVC is configured.

- Enable the router to accept InARP reply when the peer router's IP address is not in the same subnet as the receiving sub-interface on which the PVC is configured.
- Does not provide support for SVC, PVC, and SVC bundles.

PVC range and PVC-in-range configuration modes support only IP.

Examples

In the following example, the router creates a static map on a VC, indicates that 10.68.34.237 is connected to this VC, and sends ATM pseudobroadcasts:

```
protocol ip 10.68.34.237 broadcast
```

In the following example, the router removes a static map from a VC and restores the default behavior for Inverse ARP (refer to the “Defaults” section):

```
no protocol ip 10.68.34.237
```

In the following example, the VC carries PPP traffic and its associated parameters:

```
protocol ppp 10.68.34.237 virtual-template
```

pseudowire-class

To specify the name of a Layer 2 pseudowire-class and enter pseudowire-class configuration mode, use the **pseudowire-class** command in global configuration mode. To remove a pseudowire class configuration, use the **no** form of this command.

pseudowire-class *pw-class-name*

no pseudowire-class *pw-class-name*

Syntax Description

pw-class-name	The name of a Layer 2 pseudowire-class.If you want to configure more than one pseudowire class, define a class name using the *pw-class-name* parameter.

Defaults

No pseudowire-class is defined.

Command Modes

Global configuration

Command History

Release	Modification
12.0(23)S	This command was introduced.
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(27)SBC	Support for this command was integrated into Cisco IOS Release 12.2(27)SBC.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **pseudowire-class** command configures a pseudowire-class template that consists of configuration settings used by all attachment circuits bound to the class. A pseudowire-class includes the following configuration settings:

- Data encapsulation type
- Control protocol
- IP address of the local Layer 2 interface
- Type of service (ToS) value in IP headers

The local interface name for each pseudowire class configured between a pair of PE routers can be the same or different.

After entering the **pseudowire-class** command, the router switches to pseudowire-class configuration mode where PW settings can be configured.

Examples

The following example shows how to enter pseudowire-class configuration mode to configure a PW configuration template named “ether-pw”:

```
Router# config t
Router(config)# pseudowire-class mpls
Router(config-pw-class)# encapsulation mpls
Router(config-pw-class)# exit
Router(config)# exit
```

Related Commands

Command	Description
pseudowire	Binds an attachment circuit to a Layer 2 PW for an xconnect service.
xconnect	Binds an attachment circuit to an Layer 2 PW for an xconnect service and then enters xconnect configuration mode.

ptp announce

Sets interval and timeout values for PTP announcement packets.

ptp announce interval *interval-value* **timeout** *timeout-value*

no ptp announce interval *interval-value* **timeout** *timeout-value*

Syntax Description

interval	Specifies the interval for PTP announce messages. The intervals are set using log base 2 values, as follows: • 4—1 packet every 16 seconds • 3—1 packet every 8 seconds • 2—1 packet every 4 seconds • 1—1 packet every 2 seconds • 0—1 packet every second
timeout	Specifies the number of PTP announcement intervals before the session times out. Valid values are 2–10.

Defaults

The default interval value is 1. The default timeout value is 3.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The recommended interval value is -6.

Examples

The following example shows how to configure a PTP announce interval:

```
Router# config t
Router(config)# interface vlan 10
Router(config-if)# ptp announce interval 3
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp enable	Enables PTP mode on an interface.

ptp boundary

To enable PTP boundary clock on an interface, use the **ptp boundary** command in interface configuration mode. To remove a boundary clock configuration, use the **no** form of this command.

ptp boundary [multicast | unicast-negotiation]

no ptp boundary [multicast | unicast-negotiation]

Syntax Description

multicast	Configures the interface as a multicast boundary clock.
unicast-negotiation	Configures the interface as a unicast boundary clock with negotiation enabled.

Defaults

No default settings or behaviors.

Command Modes

Interface configuration

Command History

Release	Modification
15.0(2)MR	This command was introduced.

Usage Guidelines

You must configure the **ptp mode boundary** global command in order to use the **ptp boundary** command.

This command is only supported on VLAN interfaces.

Examples

The following example shows how to configure an interface as a PTP boundary clock:

```
Router# config t
Router(config)# ptp mode boundary
Router(config)# ptp priority1 128
Router(config)# ptp priority2 128
Router(config)# ptp domain 1
Router(config)# interface vlan1
Router(config-if)# ip address 192.168.1.2 255.255.255.0
Router(config-if)# ptp announce interval 3
Router(config-if)# ptp announce timeout 2
Router(config-if)# ptp sync interval -4
Router(config-if)# ptp delay-req interval -4
Router(config-if)# ptp boundary multicast
Router(config-if)# ptp enable
```

Related Commands

Command	Description
ptp mode	Specifies the transport mode for Precision Time Protocol (PTP).
ptp enable	Enables PTP mode on an interface.

ptp clock-destination

Specifies the IP address of a clock destination. This command applies only when the router is in PTP master unicast mode.

ptp clock-destination *clock-ip-address*

no ptp clock-destination *clock-ip-address*

Syntax Description

clock-ip-address	The IP address of the clock destination.

Defaults

There is no default setting.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If the router is set to ptp master unicast, you can only configure a single destination. If the router is set to ptp master unicast negotiation, you do not need to use this command as the router uses negotiation to determine the IP address of PTP slave devices.

Examples

The following example shows how to configure a PTP announcement:

```
Router# config t
Router(config)# interface vlan 10
Router(config-if)# ptp clock-destination 192.168.1.2
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp enable	Enables PTP mode on an interface.
ptp master	Sets an interface in master clock mode for PTP clocking
ptp mode	Specifies the PTP mode.
ptp clock-source	Specifies a PTP clock source.

ptp clock-source

Specifies the IP address of the clock source. This command only applies when the router is in PTP slave mode.

ptp clock-source *clock-ip-address*

no ptp clock-source *clock-ip-address*

Syntax Description

clock-ip-address	The IP address of the clock source.

Defaults

The default setting is **no ptp clock-source**.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	Support for hot standby master clock was introduced.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When the router is in PTP unicast slave mode, you can enable a hot standby master clock by configuring two **ptp clock-source** statements. A hot standby master clock allows the MWR 2941 to measure recovered clock quality from two PTP master clocks and switch dynamically between them. The MWR 2941 switches to the standby master clock when there is a lock between the router and clocking device and the advertised clock quality is greater than the current master clock.

Note Hot standby master clocking is an alternative to best master clock and disables best master clock when it is enabled.

Examples

The following example shows how to configure a PTP clock source:

```
Router# config t
Router(config)# interface vlan 10
Router(config-if)# ptp clock-source 192.168.1.1
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp enable	Enables PTP mode on an interface.
ptp mode	Specifies the PTP mode.

Command	Description
ptp slave	Sets an interface to slave clock mode for PTP clocking.
ptp clock-destination	Specifies a PTP clock destination.

ptp delay-req interval

Specifies the delay request interval, the time recommended to member devices to send delay request messages when an interface is in PTP master mode.

ptp delay-req interval [*interval-value*]

no ptp delay-req interval [*interval-value*]

Syntax Description

interval	Specifies an interval for PTP delay requests.
interval-value	Specifies the length of the interval for delay request messages. The intervals are set using log base 2 values, as follows: 4—1 packet every 16 seconds 3—1 packet every 8 seconds 2—1 packet every 4 seconds 1—1 packet every 2 seconds 0—1 packet every second -1—1 packet every 1/2 second, or 2 packets per second -2—1 packet every 1/4 second, or 4 packets per second -3—1 packet every 1/8 second, or 8 packets per second -4—1 packet every 1/16 seconds, or 16 packets per second. -5—1 packet every 1/32 seconds, or 32 packets per second. -6—1 packet every 1/64 seconds, or 64 packets per second. The recommended value is -6.

Defaults

This command is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The recommended interval value is -6.

Examples

The following example shows how to configure a PTP delay-req interval:

```
Router# config t
Router(config)# interface vlan 10
Router(config-if)# ptp delay-req interval -4
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp delay-req unicast	Configures the Cisco MWR 2941 to send unicast PTP delay request messages while in multicast mode.

ptp delay-req unicast

Configures the Cisco MWR 2941 to send unicast PTP delay request messages while in multicast mode. This command helps reduce unnecessary PTP delay request traffic.

ptp delay-req unicast *{***negotiation | no-negotiation***}*

no ptp delay-req unicast *{***negotiation | no-negotiation***}*

Syntax Description

unicast	Configures the Cisco MWR 2941 to send unicast PTP delay request messages while in multicast mode.
negotiation	Unicast negotiation configures the Cisco MWR 2941 to discover the PTP master clock by sending delay request messages to all devices specified as PTP clock sources in the local router configuration.
no-negotiation	The **no-negotiation** parameter disables unicast negotiation on the Cisco MWR 2941 in slave mode. If you disable unicast negotiation, ensure that the PTP master clock is configured with the slave IP address. The slave Cisco MWR 2941 obtains the PTP master IP address from Announce messages received from the PTP master clock. The Cisco MWR 2941 then sends delay request messages to the PTP master clock.

Defaults

This command is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If the Cisco MWR 2941 is in PTP multicast slave mode using unicast delay request messages and is connected to another Cisco MWR 2941 as a master clock, ensure that the master clock is also configured to use unicast delay request messages.

Examples

The following example shows how to configure PTP delay-req unicast:

```
Router# config t
Router(config)# interface vlan 10
Router(config-if)# ptp delay-req unicast negotiation
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp delay-req interval	Specifies the PTP delay request interval.

ptp domain

PTP domains allow you to use multiple independent PTP clocking subdomains on a single network. Use this command to specify the PTP domain number that the router uses.

ptp domain *domain-number*

no ptp domain *domain-number*

Syntax Description

domain-number	The PTP domain that the router applies to PTP traffic. Valid values are from 0–127.

Defaults

The default setting is **ptp domain 0**.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to set the ptp domain:

```
Router# config t
Router# ptp domain 88
Router(config)# exit
```

Related Commands

Command	Description
ptp enable	Enables PTP mode on an interface.
ptp mode	Specifies the PTP mode.

ptp enable

Enables PTP clocking on an interface.

ptp enable

no ptp enable

Defaults

PTP is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was modified to support PTP on multiple VLANs simultaneously.

Usage Guidelines

You can apply this command to multiple interfaces. You can configure up to two interfaces to operate as PTP slave devices simultaneously.

Examples

The following example shows how to configure a PTP announcement:

```
Router# config t
Router(config)# interface vlan 10
Router(config-if)# ptp enable
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp master	Sets an interface in master clock mode for PTP clocking
ptp mode	Specifies the PTP mode.
ptp slave	Sets an interface to slave clock mode for PTP clocking.

ptp input

Enables PTP input clocking using the 1.544Mhz, 2.048Mhz, or 10Mhz timing interface or time of day messages using the 1PPS interface.

ptp input {{{10M | 2.048M | 1.544M} [1pps]} | 1pps}

no ptp input {{{10M | 2.048M | 1.544M} [1pps]} | 1pps}

Syntax Description

10M	Specifies PTP input at 10 Mhz using the 10Mhz timing port.
2.048M	Specifies PTP input at 2.048 Mhz using the 10Mhz timing port.
1.544M	Specifies PTP input at 1.544 Mhz using the 10Mhz timing port.
1pps	Configures the router to receive 1 packet per second (1PPS) time of day messages using the RS422 port or 1PPS port. You can select 1PPS with or without selecting a timing port.

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If you are using GPS to provide clock source to the router, configure this command in PTP master mode.

Examples

The following examples show how to configure PTP input clocking:

```
Router# config t
Router(config)# ptp input 10M
Router(config)# network-clock-select 5 10M
Router(config)# exit

Router# config t
Router(config)# ptp input 1pps
Router(config)# exit
```

Related Commands

Command	Description
network-clock-select	Specifies a network clock timing source and priority.

ptp master

Sets an interface in master clock mode for PTP clocking. To enable ordinary master clock mode, use the **ptp master** command in interface configuration mode. To disable this feature, use the **no** form of this command.

ptp master {multicast | unicast [negotiation]}

no ptp master {multicast | unicast [negotiation]}

Syntax Description

multicast	Sets the interface to use multicast mode for PTP clocking.
unicast	Sets the interface to use unicast mode for PTP clock. **Note** If the router is set to **ptp master unicast**, you can only configure a single destination.
negotiation	Sets the interface to negotiate unicast mode for PTP clocking. **Note** If the router is set to **ptp master unicast negotiation**, you do not need to configure PTP clock destinations as the router uses negotiation to determine the IP address of PTP slave devices.

Defaults

There is no default setting.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

For unicast and unicast negotiation, you must configure the ip address of the remote slave using the **ptp clock-destination** command before enabling PTP.

Examples

The following example shows how to enable ptp master multicast mode:

```
Router# config t
Router# interface Vlan10
Router(config-if)# ptp master multicast
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp clock-destination	Specifies the IP address of a clock destination when the router is in PTP master mode.
ptp enable	Enables PTP mode on an interface.
ptp mode	Specifies the PTP mode.

ptp min-timing-pkt-size

This command allows you to modify the default size of PTP timing packets; in some conditions, modifying the PTP packet size can improve clock recovery performance.

ptp min-timing-pkt-size *size*

no ptp min-timing-pkt-size *size*

Syntax Description

size	Specifies the minimum PTP timing packet size in bytes. Valid values are 86–1510. The default value is 86.

Defaults

The default timing packet size is 86 bytes.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is not part of the IEEE-2008 PTP standard.

Examples

The following example shows how to enable ptp master multicast mode:

```
Router# config t
Router(config)# ptp min-timing-pkt-size 100
Router(config)# exit
```

Related Commands

Command	Description
ptp clock-destination	Specifies the IP address of a clock destination when the router is in PTP master mode.
ptp enable	Enables PTP mode on an interface.
ptp mode	Specifies the PTP mode.

ptp mode

To specify the transport mode for Precision Time Protocol (PTP), use the **ptp mode** command in global configuration mode. To remove a PTP mode configuration, use the **no** form of this command.

ptp mode [ordinary | boundary]

no ptp mode [ordinary | boundary]

Note The Cisco MWR 2941 does not currently support other PTP transport modes.

Syntax Description

ordinary	Sets the router to act as a PTP ordinary clock.
boundary	Sets the router to act as a PTP boundary clock.

Defaults

The default setting is **ptp mode ordinary**.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(2)MR	Support for the **boundary** parameter was added.

Usage Guidelines

For more information about configuring PTP, see the *Cisco MWR 2941-DC Mobile Wireless Edge Router Software Configuration Guide.*

Examples

The following example shows how to enable ptp mode:

```
Router# config t
Router(config)# ptp mode ordinary
Router(config)# exit
```

Related Commands

Command	Description
ptp enable	Enables PTP mode on an interface.
ptp master	Sets an interface in master clock mode for PTP clocking
ptp slave	Sets an interface to slave clock mode for PTP clocking.

ptp output

Enables PTP output clocking using the 1.544Mhz, 2.048Mhz, or 10Mhz timing interface or time of day messages using the 1PPS interface.

ptp output {{{10M | 2.048M | 1.544M} [1pps [offset *offset-value*] **[pulse-width** *pulse-amount* **{ns | us | ms}]]} | 1pps [pulse-width** *pulse-amount* **{ns | us | ms}]}**

no ptp output {{{10M | 2.048M | 1.544M} [1pps [pulse-width *pulse-amount* **{ns | us | ms}]]} | 1pps [offset** *offset-value*] **[pulse-width** *pulse-amount* **{ns | us | ms}]}**

Syntax Description

10M	Specifies PTP output using the 10Mhz timing interface.
2.048M	Specifies PTP output using the 2.048Mhz timing interface.
1.544M	Specifies PTP output using the 1.544Mhz timing interface.
1pps	Configures the router to send 1 packet per second (1PPS) time of day messages using the RS422 port or 1PPS port. You can select 1PPS output with or without selecting a timing port.
offset	Specifies an offset in order to compensate for a known phase error such as network asymmetry.
offset-value	Specifies the amount of offset in nanoseconds. Valid values are -500000000 to 500000000.
pulse-width	Specifies a pulse width value.
pulse-amount	*Specifies the amount of the pulse width. Valid values are 1–4096.* For 1PPS output using the RS422 port, you must specify a value of at least 2ms.
ns	Specifies a pulse width value in nanoseconds.
us	Specifies a pulse width value in microseconds.
ms	Specifies a pulse width value in milliseconds.

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If you want to provide output frequency clock, configure this command in PTP slave mode.

Examples

The following example shows how to configure PTP output clocking:

```
Router# config t
Router(config)# ptp output 10M 1pps pulse-width 1000 ms
Router(config)# exit
```

Related Commands

Command	Description
network-clock-select	Specifies a network clock timing source and priority.

ptp priority1

Sets the preference level for a clock; slave devices use the priority1 value when selecting a master clock. The priority1 value is considered above all other clock attributes. Use the following commands to set the ptp priority1 value.

ptp priority1 *priorityvalue*

no ptp priority1 *priorityvalue*

Syntax Description

priorityvalue	Valid values are from 0–255. The default value is 128.

Defaults

The default value is 128.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to enable ptp priority1 value:

```
Router# config t
Router# interface Vlan10
Router(config-if)# ptp priority1 128
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp priority2	Sets the PTP priority2 value.

ptp priority2

Sets a secondary preference level for a clock; slave devices use the priority2 value when selecting a master clock. The priority2 value is considered only when the router is unable to use priority2 and other clock attributes to select a clock. Use the following commands to set the ptp priority2 value.

ptp priority2 *priorityvalue*

no ptp priority2 *priorityvalue*

Syntax Description

priorityvalue	Valid values are from 0–255. The default value is 128.

Defaults

The default value is 128.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to configure the ptp priority2 value:

```
Router# config t
Router# interface Vlan10
Router(config-if)# ptp priority2 128
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp priority1	Sets the PTP priority1 value.

ptp slave

Sets an interface to slave clock mode for PTP clocking. To enable ordinary slave clock mode, use the **ptp slave** command in interface configuration mode. To disable this feature, use the feature, use the **no** form of this command.

Note The Cisco MWR 2941 only supports multicast routing for PTP redundancy. For more information, see the *Cisco MWR 2941-DC Mobile Wireless Edge Router Software Configuration Guide*.

ptp slave {multicast | unicast [negotiation]} [hybrid]

no ptp slave {multicast | unicast [negotiation]} [hybrid]

Syntax Description

multicast	Sets the interface to use multicast mode for PTP clocking.
unicast	Sets the interface to use unicast mode for PTP clocking.
negotiation	Sets the interface to negotiate unicast mode for PTP clocking.
hybrid	Enables hybrid clocking mode, in which the Cisco MWR 2941 uses clock frequency obtained from the synchronous Ethernet port while using phase (ToD or 1PPS) obtained using PTP. You must enable synchronous Ethernet network clocking to configure hybrid mode.

Defaults

There is no default setting.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	Added parameter to enable hybrid clocking mode.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You must configure the IP address of the remote timing device before enabling PTP.

To configure hybrid mode, ensure that you have selected a synchronous Ethernet timing source using the **network-clock-select** command. You cannot configure hybrid mode if **network-clock-select** is configured for packet timing.

Examples

The following example shows how to enable ptp slave multicast mode:

```
Router# config t
Router# interface Vlan10
Router(config-if)# ptp slave multicast
Router(config-if)# exit
```

```
Router(config)# exit
```

Related Commands

Command	Description
ptp clock-source	Specifies the IP address of the clock source. This command only applies when the router is in PTP slave mode.
ptp enable	Enables PTP mode on an interface.
ptp mode	Specifies the PTP mode.

ptp sync interval

Specifies the interval used to send PTP announcement messages.

ptp sync interval *interval-value*

no ptp sync interval *interval-value*

Syntax Description

interval	Specifies an interval for sending PTP announcement packets.
interval-value	Specifies the interval at which the router sends announcement packets. The intervals are set using log base 2 values, as follows: 4—1 packet every 16 seconds 3—1 packet every 8 seconds 2—1 packet every 4 seconds 1—1 packet every 2 seconds 0—1 packet every second -1—1 packet every 1/2 second, or 2 packets per second -2—1 packet every 1/4 second, or 4 packets per second -3—1 packet every 1/8 second, or 8 packets per second -4—1 packet every 1/16 seconds, or 16 packets per second. -5—1 packet every 1/32 seconds, or 32 packets per second. -6—1 packet every 1/64 seconds, or 64 packets per second. The recommended value is -6.

Defaults

There is no default setting.

Command Modes

Interface configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to configure a PTP announcement interval.

```
Router# config t
Router(config)# interface vlan 10
Router(config-if)# ptp sync interval -4
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
ptp clock-source	Specifies the IP address of the clock source. This command only applies when the router is in PTP slave mode.
ptp enable	Enables PTP mode on an interface.
ptp mode	Specifies the PTP mode.

ptp tod

Configures the time of day message format used by the 1PPS interface.

ptp tod {iso8601 | ubx | nmea | cisco | ntp} *delay-amount*

no ptp tod {iso8601 | ubx | nmea | cisco | ntp} *delay-amount*

Syntax Description

iso8601	Specifies ISO 8601 time of day format.
ubx	Specifies UBX time of day format.
nmea	Specifies NMEA time of day format.
cisco	Specifies Cisco time of day format.
ntp	Specifies NTP time of day format.
delay-amount	Specifies the delay in milliseconds between the 1PPS message and the time of day message. Valid values are 1–999.

Defaults

The default configuration is **ptp tod iso8601**.

Command Modes

Global configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command applies only to the Cisco MWR 2941-DC-A; it does not apply to the Cisco MWR 2941-DC.

Examples

The following example shows how to configure a PTP announcement interval.

```
Router# config t
Router(config)# ptp tod ubx 100
Router(config)# exit
Router#
```

Related Commands

Command	Description
ptp enable	Enables PTP mode on an interface.
ptp mode	Specifies the PTP mode.
ptp 1pps enable	Configures the router to send or receive 1PPS time of day messages.

ptp two-steps

The default PTP synchronization consists of a one-step handshake between the PTP master and slave devices. The **ptp two-steps** command configures the master clock to send a follow-up message containing the timestamp of the original synchronization message. This command is useful when the Cisco MWR 2941 is acting as the PTP master and is connected to a slave device that requires a two-step handshake.

ptp two-steps

no ptp two-steps

Note When configured as a PTP slave device, the Cisco MWR 2941 can use a one– or two–step handshake.

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to configure a PTP two-step handshake:

```
Router# config t
Router(config-if)# ptp two-steps
Router(config)# exit
```

Related Commands

Command	Description
ptp sync interval	Defines the interval that the router uses to send PTP synchronization messages.

ptp update-calendar

Configures the router to periodically update the system calendar to match the PTP clock.

ptp update-calendar

no ptp update-calendar

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to configure a PTP announcement interval.

```
Router# config t
Router(config)# ptp update-calendar
Router(config)# exit
```

Related Commands

Command	Description
clock update-calendar	Manually updates the system time to match the PTP clock time.

ql-enabled rep segment

To specify the REP segment used for synchronous Ethernet clock selection, use the **ql-enabled rep segment** command in global configuration mode.

For more information about clock selection, see the *Cisco MWR 2941-DC Mobile Wireless Edge Router Software Configuration Guide.*

ql-enabled rep segment *segment-id*

no ql-enabled rep segment *segment-id*

Syntax Description

segment	Specifies a REP segment.
segment-id	The REP segment ID of the REP segment

Command Default

None

Command Modes

Global configuration

Command History

Release	Modification
12.2(33)MRA	This command was introduced.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command requires that you specify a synchronous Ethernet clock source.

Examples

The following example shows how to use the **ql-renabled rep segment** command:

```
Router# config t
Router(config)# ql-enabled rep segment 5
Router(config)# exit
```

Related Commands

Command	Description
rep segment	Enables Resilient Ethernet Protocol (REP) on an interface assigns a segment ID.

queue-limit

To specify or modify the queue limit (size) for a class in bytes, milliseconds (ms), or packets use the **queue-limit** command in policy-map class configuration mode. To remove the queue limit from a class, use the **no** form of this command.

queue-limit *queue-limit-size* **[bytes | ms |packets]**

no queue-limit

Syntax Description

queue-limit-size	The maximum size of the queue. The maximum varies according to the optional unit of measure keyword specified (**bytes**, **ms**, or **packets**). **Note** If an optional unit of measure is not indicated, the default unit of measure is packets.
bytes	(Optional) Indicates that the unit of measure is bytes. Valid range for bytes is a number from 1 to 8192000.
ms	(Optional) Indicates that the unit of measure is milliseconds. Valid range for milliseconds is a number from 1 to 3400.
packets	(Optional) Indicates that the unit of measure is packets. Valid range for packets is a number from 1 to 32768 but can also vary by platform and release.

Command Default

The default behavior of the **queue-limit** command for class queues with and without weighted random early detection (WRED) is:

- Class queues with WRED—The router uses the default queue limit of two times the largest WRED maximum threshold value, rounded to the nearest power of 2.
- Priority queues and class queues without WRED—The router has buffers for up to 50 ms of 256-byte packets at line rate, but not fewer than 32 packets.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE. Support for VIP-enabled Cisco 7500 series routers was added.
12.0(17)SL	This command was implemented on the Cisco 10000 series router.
12.1(5)T	This command was implemented on the VIP-enabled Cisco 7500 series routers.
12.2(16)BX	This command was introduced on the ESR-PRE2.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.3(7)XI	This command was integrated into Cisco IOS Release 12.3(7)XI.

Release	Modification
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)T	The following argument/keyword combinations were added: • *queue-limit-size* **bytes** • *queue-limit-size* **ms** • *queue-limit-size* **packets**
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release also does not support Weighted Random Early Detection (WRED).

Usage Guidelines

Weighted Fair Queueing

Weighted fair queueing (WFQ) creates a queue for every class for which a class map is defined. Packets that satisfy the match criterion for a class accumulate in the queue reserved for the class until they are sent, which occurs when the queue is serviced by the fair queueing process. When the maximum packet threshold that you defined for the class is reached, enqueueing of any further packets to the class queue causes tail drop or, if WRED is configured for the class policy, packet drop to take effect.

Overriding Queue Limits Set by the bandwidth Command

Use the **bandwidth** command with the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC) to specify the bandwidth for a particular class. When used with MQC, the **bandwidth** command has a default queue limit for the class. This queue limit can be modified using the **queue-limit** command, thereby overriding the default set by the **bandwidth** command.

Note Using the **queue-limit** command to modify the default queue limit is especially important for higher-speed interfaces, in order to meet the minimum bandwidth guarantees required by the interface.

Examples

The following example configures a policy map called policy11. The policy11 policy map contains a class called acl203. The policy map for this class is configured so that the queue reserved for the class has a maximum queue size of 40 packets.

```
Router(config)# policy-map policy11
Router(config-pmap)# class acl203
Router(config-pmap-c)# bandwidth 2000
Router(config-pmap-c)# queue-limit 40 packets
```

Related Commands

Command	Description
bandwidth	Specifies the maximum aggregate bandwidth for H.323 traffic and verifies the available bandwidth of the destination gatekeeper.
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
class class-default	Specifies the default traffic class whose bandwidth is to be configured or modified.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

recovered-clock slave

To configure out-of-band clock recovery, use the **recovered-clock slave** command. This command automatically creates a virtual-cem interface. To access the virtual-cem interface, use the command **interface virtual-cem 0/24**. To disable this feature, use the feature, use the **no** form of this command.

recovered-clock slave

no recovered-clock slave

Defaults

There is no default setting.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the **recovered-clock slave** command and how to configure the virtual-cem interface:

```
Router# config t
Router(config)# recovered-clock slave
Router(config-if)# interface virtual-cem 0/24
Router(config-if)# payload-size 486
Router(config-if)# cem 0
Router(config-if)# xconnect 10.10.10.2 7600 encap mpls
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
recovered-clock recovered	Configures adaptive clock recovery.

recovered-clock recovered

The **recovered-clock recovered** command allows you to configure in-band pseudowire-based active clock recovery on a CEM interface. To disable this feature, use the feature, use the **no** form of this command.

recovered-clock recovered adaptive cem *subslot-number port-number cem-group-number*

no recovered-clock recovered adaptive cem *subslot-number port-number cem-group-number*

Syntax Description

adaptive	Specifies the clock recovery type.
cem	Specifies the Circuit emulation (CEM) interface for the recovered clock.
subslot-number	The subslot of the CEM interface for the recovered clock.
port-number	The port number of the CEM interface for the recovered clock.
cem-group-number	The CEM group to which the clock applies.

Defaults

There is no default setting.

Command Modes

Global configuration

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

For more information about adaptive clock recovery, see the *Cisco MWR 2941-DC Mobile Wireless Edge Router Software Configuration Guide.*

Examples

The following example shows how to use the **recovered-clock recovered** command:

```
Router# config t
Router(config)# recovered-clock recovered adaptive cem 0 0 0
Router(config)# exit
```

Related Commands

Command	Description
recovered-clock slave	Allows you to configure out-of-band clock recovery,

rep admin vlan

Use the **rep admin vlan** global configuration command to configure a Resilient Ethernet Protocol (REP) administrative VLAN for REP to transmit hardware flood layer (HFL) messages. Use the **no** form of this command to return to the default configuration with VLAN 1 as the administrative VLAN.

rep admin vlan *vlan-id*

no rep admin vlan

Syntax Description

vlan-id	The VLAN ID range is from 1 to 4094. The default is VLAN 1; the range to configure is 2 to 4094.

Defaults

The administrative VLAN is VLAN 1.

Command Modes

Global configuration

Command History

Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If the VLAN does not already exist, this command does not create the VLAN.

To avoid the delay introduced by relaying messages in software for link-failure or VLAN-blocking notification during load balancing, REP floods packets at the hardware flood layer (HFL) to a regular multicast address. These messages are flooded to the whole network, not just the REP segment. Switches that do not belong to the segment treat them as data traffic. Configuring an administrative VLAN for the whole domain can control flooding of these messages.

If no REP administrative VLAN is configured, the default is VLAN 1.

There can be only one administrative VLAN on a switch and on a segment.

The administrative VLAN cannot be the RSPAN VLAN.

Examples

This example shows how to configure VLAN 100 as the REP administrative VLAN:

```
Router (config)# rep admin vlan 100
```

You can verify your settings by entering the **show interface rep detail** privileged EXEC command.

Related Commands

Command	Description
show interfaces rep detail	Displays detailed REP configuration and status for all interfaces or the specified interface, including the administrative VLAN.

rep block port

Use the **rep block port** interface configuration command on the REP primary edge port to configure Resilient Ethernet Protocol (REP) VLAN load balancing. Use the **no** form of this command to return to the default configuration.

rep block port {id *port-id* **|** *neighbor_offset* **| preferred} vlan {*vlan-list* | all}**

no rep block port {**id** *port-id* **|** *neighbor_offset* **| preferred**}

Syntax Description

id *port-id*	Identify the VLAN blocking alternate port by entering the unique port ID that is automatically generated when REP is enabled. The REP port ID is a 16-character hexadecimal value. You can view the port ID for an interface by entering the **show interface** *interface-id* **rep detail** command.
neighbor_offset	Identify the VLAN blocking alternate port by entering the offset number of a neighbor. The range is –256 to +256; a value of 0 is invalid. The primary edge port has an offset number of 1; positive numbers above 1 identify downstream neighbors of the primary edge port. Negative numbers identify the secondary edge port (offset number -1) and its downstream neighbors.
preferred	Identify the VLAN blocking alternate port as the segment port on which you entered the **rep segment** *segment-id* **preferred** interface configuration command. **Note** Entering the **preferred** keyword does not ensure that the preferred port is the alternate port; it gives it preference over other similar ports.
vlan	Identify the VLANs to be blocked.
vlan-list	Enter a VLAN ID from 1 to 4094 or a range or sequence of VLANs (such as 1-3, 22, 41-44) of VLANs to be blocked.
all	Enter to block all VLANs.

Defaults

The default behavior after you enter the **rep preempt segment** privileged EXEC command (for manual preemption) is to block all VLANs at the primary edge port. This behavior remains until you configure the **rep block port** command.

If the primary edge port cannot determine which port is to be the alternate port, the default action is no preemption and no VLAN load balancing.

Command Modes

Interface configuration

Command History

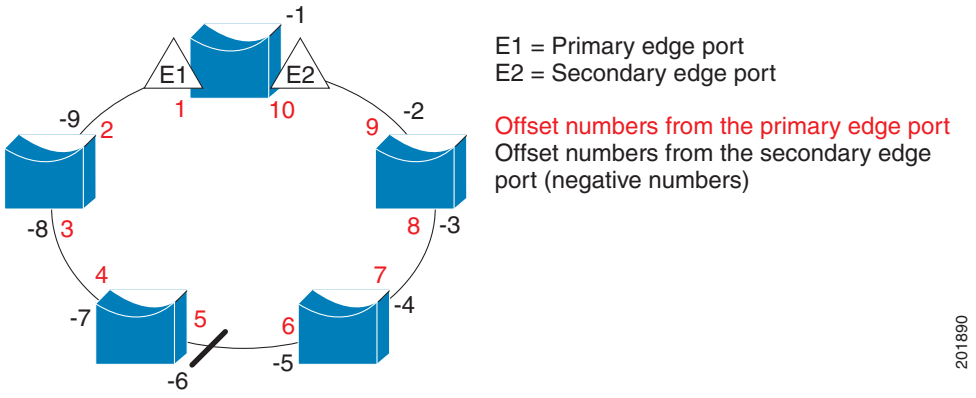
Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You must enter this command on the REP primary edge port.

When you select an alternate port by entering an offset number, this number identifies the downstream neighbor port of an edge port. The primary edge port has an offset number of 1; positive numbers above 1 identify downstream neighbors of the primary edge port. Negative numbers identify the secondary edge port (offset number -1) and its downstream neighbors. See Neighbor Offset Numbers in a REP SegmentFigure 1-2.

Figure 1-2 Neighbor Offset Numbers in a REP Segment



Note You would never enter an offset value of 1 because that is the offset number of the primary edge port itself.

If you have configured a preempt delay time by entering the **rep preempt delay** *seconds* interface configuration command and a link failure and recovery occurs, VLAN load balancing begins after the configured preemption time period elapses without another link failure. The alternate port specified in the load-balancing configuration blocks the configured VLANs and unblocks all other segment ports. If the primary edge port cannot determine the alternate port for VLAN balancing, the default action is no preemption.

Each port in a segment has a unique port ID. The port ID format is similar to the one used by the spanning tree algorithm: a port number (unique on the bridge) associated to a MAC address (unique in the network). To determine the port ID of a port, enter the **show interface** *interface-id* **rep detail** privileged EXEC command.

Examples

This example shows how to configure REP VLAN load balancing on the Switch B primary edge port (Gigabit Ethernet port 0/1) and to configure Gigabit Ethernet port 0/2 of Switch A as the alternate port to block VLANs 1 to 100. The alternate port is identified by its port ID, shown in bold in the output of the **show interface rep detail** command for the Switch A port.

```
Switch A# show interface gigabitethernet0/2 rep detail
GigabitEthernet0/2 REP enabled
Segment-id: 2 (Segment)
PortID: 0080001647FB1780
Preferred flag: No
Operational Link Status: TWO_WAY
Current Key: 007F001647FB17800EEE
Port Role: Open
Blocked Vlan: <empty>
Admin-vlan: 1
Preempt Delay Timer: 35 sec
Load-balancing block port: none
```

```
Load-balancing block vlan: none
STCN Propagate to:
PDU/TLV statistics:
LSL PDU rx: 107122, tx: 192493

Router# config t
Router (config)# interface gigabitethernet0/1
Router (config-if)# rep block port id 0080001647FB1780 vlan 1-100
Router (config-if)# exit
```

This example shows how to configure VLAN load balancing by using a neighbor offset number and how to verify the configuration by entering the **show interfaces rep detail** privileged EXEC command:

```
Router# config t
Router (config)# interface gigabitethernet0/2
Router (config-if)# rep block port 6 vlan 1-110
Router (config-if)# end

Router# show interface gigabitethernet0/2 rep detail
GigabitEthernet0/2 REP enabled
Segment-id: 2 (Segment)
PortID: 0080001647FB1780
Preferred flag: No
Operational Link Status: TWO_WAY
Current Key: 007F001647FB178009C3
Port Role: Open
Blocked Vlan: <empty>
Admin-vlan: 3
Preempt Delay Timer: 35 sec
Load-balancing block port: 6
Load-balancing block vlan: 1-110
STCN Propagate to: none
LSL PDU rx: 1466780, tx: 3056637
HFL PDU rx: 2, tx: 0
BPA TLV rx: 1, tx: 2119695
BPA (STCN, LSL) TLV rx: 0, tx: 0
BPA (STCN, HFL) TLV rx: 0, tx: 0
EPA-ELECTION TLV rx: 757406, tx: 757400
EPA-COMMAND TLV rx: 1, tx: 1
EPA-INFO TLV rx: 178326, tx: 178323
```

Related Commands

Command	Description
rep preempt delay	Configures a waiting period after a segment port failure and recovery before REP VLAN load balancing is triggered.
rep preempt segment	Manually starts REP VLAN load balancing on a segment.
show interfaces rep detail	Displays REP detailed configuration and status for all interfaces or the specified interface, including the administrative VLAN.

rep lsl-age-timer

To configure the Link Status Layer (LSL) age timer with the time period that the REP interface remains up without receiving a hello from the REP neighbor, use the **rep lsl-age-timer** command in interface configuration mode on a Resilient Ethernet Protocol (REP) port. Use the **no** form of this command to return to the default time.

rep lsl-age-timer *value*

no rep lsl-age-timer

Syntax Description

value	Specifies the amount of idle time (time in which the router does not receive a LSL HELLO message) before the router disables a REP link. Timer values are specified in multiples of 40ms; valid values are 120–10000.

Command Default

The default values is 5000 ms (5 seconds).

Command Modes

Interface configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

The LSL hello timer is set to the age timer value divided by 3 so that there should be at least two LSL hellos sent within the LSL age timer period. If no hellos are received within that time, the Cisco MWR 2941 disables the REP link.

This command requires that the REP port be in trunking mode.

Examples

This example shows how to configure a REP LSL timer of 160 ms on the primary edge port:

```
Router (config)# interface gigabitethernet0/1
Router (config-if)# rep lsl-age-timer 160
Router (config-if)# exit
```

You can verify your settings by entering the **show interfaces rep** privileged EXEC command.

Related Commands

Command	Description
show interfaces rep	Displays REP configuration and status for all interfaces or a specified interface.

rep lsl-retries

To configure the Resilient Ethernet Protocol (REP) link status layer (LSL) number of retries, use the **rep lsl-retries** command in interface configuration mode. To restore the default number of retries, use the **no** form of this command.

rep lsl-retries *number-of-retries*

no rep lsl-retries *number-of-retries*

Syntax Description

number-of-retries	Specifies the number of LSL retries. The acceptable range is between 3 and 10 retries. The default number of retries is 5.

Command Default

The default number of retries is 5.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
15.0(1)S	This command was introduced on the Cisco 7600 series routers.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

REP is a Cisco proprietary protocol that provides functionality to:

- Control network loops
- Handle link failures
- Improve convergence time

The **rep lsl-retries** command is used to configure the number of retries before the REP link is disabled.

Examples

This example shows how to configure REP link status layer number of retries.

```
Router# enable
Router# configure terminal
Router(config)# interface gigabitethernet 2/5
Router(config-if)# rep segment 2 edge primary
Router(config-if)# rep lsl-retries 4
Router(config-if)# exit
```

Related Commands

Command	Description
rep lsl-age-timer	Configures the REP link status layer age-out timer value.

rep preempt delay

Use the **rep preempt delay** interface configuration command on the REP primary edge port to configure a waiting period after a segment port failure and recovery before Resilient Ethernet Protocol (REP) VLAN load balancing is triggered. Use the **no** form of this command to remove the configured delay.

rep preempt delay *seconds*

no rep preempt delay

Syntax Description

seconds	Set the number of seconds to delay REP preemption. The range is 15 to 300.

Defaults

No preemption delay is set. If you do not enter the **rep preempt delay** command, the default is manual preemption with no delay.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was introduced.

Usage Guidelines

You must enter this command on the REP primary edge port.

You must enter this command and configure a preempt time delay if you want VLAN load balancing to automatically trigger after a link failure and recovery.

If VLAN load balancing is configured, after a segment port failure and recovery, the REP primary edge port starts a delay timer before VLAN load balancing occurs. Note that the timer restarts after each link failure. When the timer expires, the REP primary edge alerts the alternate port to perform VLAN load balancing (configured by using the **rep block port** interface configuration command) and prepares the segment for the new topology. The configured VLAN list is blocked at the alternate port, and all other VLANs are blocked at the primary edge port.

Examples

This example shows how to configure a REP preemption time delay of 100 seconds on the primary edge port:

```
Router (config)# interface gigabitethernet0/1
Router (config-if)# rep preempt delay 100
Router (config-if)# exit
```

You can verify your settings by entering the **show interfaces rep** privileged EXEC command.

Related Commands

Command	Description
rep block port	Configures VLAN load balancing.
show interfaces rep	Displays REP configuration and status for all interfaces or a specified interface.

rep preempt segment

Use the **rep preempt segment** privileged EXEC command to manually start Resilient Ethernet Protocol (REP) VLAN load balancing on a segment.

rep preempt segment *segment_id*

Syntax Description

segment-id	ID of the REP segment. The range is from 1 to 1024.

Defaults

Manual preemption is the default behavior.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When you enter the **rep preempt segment** *segment-id* command, a confirmation message appears before the command is executed because preemption can cause network disruption.

Enter this command on the switch on the segment that has the primary edge port.

If you do not configure VLAN load balancing, entering this command results in the default behavior—the primary edge port blocks all VLANs.

You configure VLAN load balancing by entering the **rep block port** {**id** *port-id* | *neighbor_offset* | **preferred**} **vlan** {*vlan-list* | **all**} interface configuration command on the REP primary edge port before you manually start preemption.

There is not a **no** version of this command.

Examples

This example shows how to manually trigger REP preemption on segment 100 with the confirmation message:

```
Router# rep preempt segment 100
The command will cause a momentary traffic disruption.
Do you still want to continue? [confirm]
```

Related Commands

Command	Description
rep block port	Configures VLAN load balancing.
show interfaces rep [**detail**]	Displays REP configuration and status for all interfaces or the specified interface.

rep segment

Use the **rep segment** interface configuration command to enable Resilient Ethernet Protocol (REP) on the interface and to assign a segment ID to it. Use the **no** form of this command to disable REP on the interface.

rep segment *segment-id* [**edge** [**no-neighbor**][**primary**]] [**preferred**]

no rep segment

Syntax Description

segment-id	Assign a segment ID to the interface. The range is from 1 to 1024.
edge	(Optional) Identify the interface as one of the two REP edge ports. Entering the **edge** keyword without the **primary** keyword configures the port as the secondary edge port.
no-neighbor	Specifies that the MWR 2941 interface does not have a REP neighbor because it is connected to a switch that does not support REP.
primary	(Optional) On an edge port, specify that the port is the primary edge port. A segment has only one primary edge port. If you configure two ports in a segment as the primary edge port, for example ports on different switches, the REP selects one of them to serve as the segment primary edge port.
preferred	(Optional) Specify that the port is the preferred alternate port or the preferred port for VLAN load balancing. **Note** Configuring a port as preferred does not guarantee that it becomes the alternate port; it merely gives it a slight edge among equal contenders. The alternate port is usually a previously failed port.

Defaults

REP is disabled on the interface.

When REP is enabled on an interface, the default is for the port to be a regular segment port.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)SRC	This command was implemented on the Cisco 7600 series router.
Cisco IOS XE Release 2.2	This command was implemented on the Cisco ASR 1000 Series Aggregation Services Router.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. Release 15.0(1)MR does not support the **no-neighbor** keyword.
15.0(1)MR	Support for the **no-neighbor** keyword was introduced.

Usage Guidelines

REP ports must be Layer 2 trunk ports.

REP ports should not be configured as one of these port types:

- SPAN destination port
- Private VLAN port
- Tunnel port
- Access port
- REP ports must be network node interfaces (NNIs). REP ports cannot be user-network interfaces (UNIs) or enhanced network interfaces (ENIs).

You must configure two edge ports on each REP segment, a primary edge port and a port to act as a secondary edge port. If you configure two ports in a segment as the primary edge port, for example ports on different switches, the configuration is allowed, but the REP selects one of them to serve as the segment primary edge port.

- REP ports follow these rules:
  - There is no limit to the number of REP ports on a switch; however, only two ports on a switch can belong to the same REP segment.
  - If only one port on a switch is configured in a segment, the port should be an edge port.
  - If two ports on a switch belong to the same segment, they must be both edge ports, both regular segment ports, or one regular port and one edge no-neighbor port. An edge port and regular segment port on a switch cannot belong to the same segment.
  - If two ports on a switch belong to the same segment and one is configured as an edge port and one as a regular segment port (a misconfiguration), the edge port is treated as a regular segment port.

If you configure two ports in a segment as the primary edge port, for example ports on different switches, the REP selects one of them to serve as the segment primary edge port. Enter the **show rep topology** privileged EXEC command on a port in the segment to verify which port is the segment primary edge port.

REP interfaces come up in a blocked state and remain in a blocked state until notified that it is safe to unblock. You need to be aware of this to avoid sudden connection losses.

You should configure REP only in networks with redundancy. Configuring REP in a network without redundancy causes loss of connectivity.

Examples

This example shows how to enable REP on a regular (nonedge) segment port:

```
Router (config)# interface gigabitethernet0/1
Router (config-if)# rep segment 100
```

This example shows how to enable REP on a port and to identify the port as the REP primary edge port:

```
Router (config)# interface gigabitethernet0/2
Router (config-if)# rep segment 100 edge primary
```

This example shows how to enable REP on a port and to identify the port as the REP secondary edge port:

```
Router (config)# interface gigabitethernet0/2
Router (config-if)# rep segment 100 edge
```

You can verify your settings by entering the **show interfaces rep** privileged EXEC command. To verify which port in the segment is the primary edge port, enter the **show rep topology** privileged EXEC command.

Related Commands

Command	Description
show interfaces rep [**detail**]	Displays REP configuration and status for all interfaces or the specified interface.
show rep topology [**detail**]	Displays information about all ports in the segment, including which one was configured and selected as the primary edge port.

rep stcn

Use the **rep stcn** interface configuration command on a Resilient Ethernet Protocol (REP) edge port to configure the port to send REP segment topology change notifications (STCNs) to another interface, to other segments, or to Spanning Tree Protocol (STP) networks. Use the **no** form of this command to disable the sending of STCNs to the interface, segment, or STP network.

rep stcn {**interface** *interface-id* | **segment** *id-list* | **stp**}

no rep stcn {**interface** | **segment** | **stp**}

Syntax Description

interface *interface-id*	Identify a physical interface or port channel to receive STCNs.
segment *id-list*	Identify one REP segment or list of segments to receive STCNs. The range is 1 to 1024. You can also configure a sequence of segments (for example 3-5, 77, 100).
stp	Send STCNs to an STP network.

Defaults

Transmission of STCNs to other interfaces, segments, or STP networks is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Enter this command on a segment edge port.

You use this command to notify other portions of the Layer 2 network of topology changes that occur in the local REP segment. This removes obsolete entries in the Layer 2 forwarding table in other parts of the network, which allows faster network convergence.

Examples

This example shows how to configure the REP primary edge port to send STCNs to segments 25 to 50:

```
Router (config)# interface gigabitethernet0/2
Router (config-if)# rep stcn segment 25-50
Router (config-if)# exit
```

You can verify your settings by entering the **show interfaces rep detail** privileged EXEC command.

Related Commands

Command	Description
show interfaces rep [**detail**]	Displays REP configuration and status for all interfaces or the specified interface.

revision

To set the revision number for the Multiple Spanning Tree (802.1s) (MST) configuration, use the **revision** command in MST configuration submode. To return to the default settings, use the **no** form of this command.

revision *version*

no revision

Syntax Description

version	Revision number for the configuration; valid values are from 0 to 65535.

Command Default

version is **0**.

Command Modes

MST configuration (config-mst)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Two Cisco 7600 series routers that have the same configuration but different revision numbers are considered to be part of two different regions.

Caution Be careful when using the **revision** command to set the revision number of the MST configuration because a mistake can put the switch in a different region.

Examples

This example shows how to set the revision number of the MST configuration:

```
Router(config-mst)# revision 5
```

Related Commands

Command	Description
instance	Maps a VLAN or a set of VLANs to an MST instance.
name (MST configuration submode)	Sets the name of an MST region.
show	Verifies the MST configuration.
show spanning-tree	Displays information about the spanning-tree state.
spanning-tree mst configuration	Enters MST-configuration submode.

router bgp

To configure the BGP routing process, use the **router bgp** command in global configuration mode. To remove a routing process, use the **no** form of this command.

router bgp *autonomous-system-number*

no router bgp *autonomous-system-number*

Syntax Description

autonomous-system-number	Number of an autonomous system that identifies the router to other BGP routers and tags the routing information that is passed along. Number in the range from 1 to 65535. For more details about autonomous system number formats, see the "Usage Guidelines" section.

Command Default

No BGP routing process is configured by default.

Command Modes

Global configuration (config)

Command History

Release	Modification
10.0	This command was introduced.
12.2(25)SG	This command was integrated into Cisco IOS Release 12.2(25)SG.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	This command was modified. Support for IPv6 was added.
12.2(14)SX	This command was integrated into Cisco IOS Release 12.2(14)SX.
12.2(33)SB	This command was modified. Support for IPv6 was added.
12.0(32)S12	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
12.0(32)SY8	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.
12.4(24)T	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
Cisco IOS XE Release 2.3	This command was modified. Support for 4-byte autonomous system numbers in asdot notation only was added.
12.2(33)SXI1	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.
12.0(33)S3	This command was modified. Support for asplain notation was added and the default format for 4-byte autonomous system numbers is now asplain.
Cisco IOS XE Release 2.4	This command was modified. Support for asplain notation was added and the default format for 4-byte autonomous system numbers is now asplain.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command allows you to set up a distributed routing core that automatically guarantees the loop-free exchange of routing information between autonomous systems.

Prior to January 2009, BGP autonomous system numbers that were allocated to companies were 2-octet numbers in the range from 1 to 65535 as described in RFC 4271, *A Border Gateway Protocol 4 (BGP-4)*. Due to increased demand for autonomous system numbers, the Internet Assigned Number Authority (IANA) will start in January 2009 to allocate four-octet autonomous system numbers in the range from 65536 to 4294967295. RFC 5396, *Textual Representation of Autonomous System (AS) Numbers*, documents three methods of representing autonomous system numbers. Cisco has implemented the following two methods:

- Asplain—Decimal value notation where both 2-byte and 4-byte autonomous system numbers are represented by their decimal value. For example, 65526 is a 2-byte autonomous system number and 234567 is a 4-byte autonomous system number.
- Asdot—Autonomous system dot notation where 2-byte autonomous system numbers are represented by their decimal value and 4-byte autonomous system numbers are represented by a dot notation. For example, 65526 is a 2-byte autonomous system number and 1.169031 is a 4-byte autonomous system number (this is dot notation for the 234567 decimal number).

For details about the third method of representing autonomous system numbers, see RFC 5396.

Asdot Only Autonomous System Number Formatting

In Cisco IOS Release 12.0(32)S12, 12.4(24)T, Cisco IOS XE Release 2.3, and later releases, the 4-octet (4-byte) autonomous system numbers are entered and displayed only in asdot notation, for example, 1.10 or 45000.64000. When using regular expressions to match 4-byte autonomous system numbers the asdot format includes a period which is a special character in regular expressions. A backslash must be entered before the period for example, 1\.14, to ensure the regular expression match does not fail. Table 1-7 shows the format in which 2-byte and 4-byte autonomous system numbers are configured, matched in regular expressions, and displayed in **show** command output in Cisco IOS images where only asdot formatting is available.

Table 1-7 Asdot Only 4-Byte Autonomous System Number Format

Format	Configuration Format	Show Command Output and Regular Expression Match Format
asdot	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535

Asplain as Default Autonomous System Number Formatting

In Cisco IOS Release 12.0(32)SY8, 12.2(33)SXI1, 12.0(33)S3, Cisco IOS XE Release 2.4, and later releases, the Cisco implementation of 4-byte autonomous system numbers uses asplain as the default display format for autonomous system numbers, but you can configure 4-byte autonomous system numbers in both the asplain and asdot format. In addition, the default format for matching 4-byte autonomous system numbers in regular expressions is asplain, so you must ensure that any regular expressions to match 4-byte autonomous system numbers are written in the asplain format. If you want to change the default **show** command output to display 4-byte autonomous system numbers in the asdot

format, use the **bgp asnotation dot** command under router configuration mode. When the asdot format is enabled as the default, any regular expressions to match 4-byte autonomous system numbers must be written using the asdot format, or the regular expression match will fail. Table 1-8 and Table 1-9 show that although you can configure 4-byte autonomous system numbers in either asplain or asdot format, only one format is used to display **show** command output and control 4-byte autonomous system number matching for regular expressions, and the default is asplain format. To display 4-byte autonomous system numbers in **show** command output and to control matching for regular expressions in the asdot format, you must configure the **bgp asnotation dot** command. After enabling the **bgp asnotation dot** command, a hard reset must be initiated for all BGP sessions by entering the **clear ip bgp *** command.

Note If you are upgrading to an image that supports 4-byte autonomous system numbers, you can still use 2-byte autonomous system numbers. The **show** command output and regular expression match are not changed and remain in asplain (decimal value) format for 2-byte autonomous system numbers regardless of the format configured for 4-byte autonomous system numbers.

Table 1-8 Default Asplain 4-Byte Autonomous System Number Format

Format	Configuration Format	Show Command Output and Regular Expression Match Format
asplain	2-byte: 1 to 65535 4-byte: 65536 to 4294967295	2-byte: 1 to 65535 4-byte: 65536 to 4294967295
asdot	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535	2-byte: 1 to 65535 4-byte: 65536 to 4294967295

Table 1-9 Asdot 4-Byte Autonomous System Number Format

Format	Configuration Format	Show Command Output and Regular Expression Match Format
asplain	2-byte: 1 to 65535 4-byte: 65536 to 4294967295	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535
asdot	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535

Reserved and Private Autonomous System Numbers

In Cisco IOS Release 12.0(32)S12, 12.0(32)SY8, 12.2(33)SXI1, 12.4(24)T, Cisco IOS XE Release 2.3 and later releases, the Cisco implementation of BGP supports RFC 4893. RFC 4893 was developed to allow BGP to support a gradual transition from 2-byte autonomous system numbers to 4-byte autonomous system numbers.

Note A new reserved (private) autonomous system number, 23456, was created by RFC 4893 and this number cannot be configured as an autonomous system number in the Cisco IOS CLI.

RFC 5398, *Autonomous System (AS) Number Reservation for Documentation Use*, describes new reserved autonomous system numbers for documentation purposes. Use of the reserved numbers allow configuration examples to be accurately documented and avoids conflict with production networks if these configurations are literally copied. The reserved numbers are documented in the IANA

autonomous system number registry. Reserved 2-byte autonomous system numbers are in the contiguous block, 64496 to 64511 and reserved 4-byte autonomous system numbers are from 65536 to 65551 inclusive.

Private 2-byte autonomous system numbers are still valid in the range from 64512 to 65534 with 65535 being reserved for special use. Private autonomous system numbers can be used for internal routing domains but must be translated for traffic that is routed out to the Internet. BGP should not be configured to advertise private autonomous system numbers to external networks. Cisco IOS software does not remove private autonomous system numbers from routing updates by default. We recommend that ISPs filter private autonomous system numbers.

Note Autonomous system number assignment for public and private networks is governed by the IANA. For information about autonomous-system numbers, including reserved number assignment, or to apply to register an autonomous system number, see the following URL: http://www.iana.org/.

Examples

The following example configures a BGP process for autonomous system 45000 and configures two external BGP neighbors in different autonomous systems using 2-byte autonomous system numbers:

```
router bgp 45000
 neighbor 192.168.1.2 remote-as 40000
 neighbor 192.168.3.2 remote-as 50000
 neighbor 192.168.3.2 description finance
 !
 address-family ipv4
  neighbor 192.168.1.2 activate
  neighbor 192.168.3.2 activate
  no auto-summary
  no synchronization
  network 172.17.1.0 mask 255.255.255.0
  exit-address-family
```

The following example configures a BGP process for autonomous system 65538 and configures two external BGP neighbors in different autonomous systems using 4-byte autonomous system numbers in asplain notation. This example is supported in Cisco IOS Release 12.0(32)SY8, 12.2(33)SXI1, 12.0(33)S3, Cisco IOS XE Release 2.4, and later releases.

```
router bgp 65538
 neighbor 192.168.1.2 remote-as 65536
 neighbor 192.168.3.2 remote-as 65550
 neighbor 192.168.3.2 description finance
 !
 address-family ipv4
  neighbor 192.168.1.2 activate
  neighbor 192.168.3.2 activate
  no auto-summary
  no synchronization
  network 172.17.1.0 mask 255.255.255.0
  exit-address-family
```

The following example configures a BGP process for autonomous system 1.2 and configures two external BGP neighbors in different autonomous systems using 4-byte autonomous system numbers in asdot notation.

```
router bgp 1.2
 neighbor 192.168.1.2 remote-as 1.0
 neighbor 192.168.3.2 remote-as 1.14
 neighbor 192.168.3.2 description finance
 !
```

```
address-family ipv4
 neighbor 192.168.1.2 activate
 neighbor 192.168.3.2 activate
 no auto-summary
```

Related Commands

Command	Description
bgp asnotation dot	Changes the default display and the regular expression match format of BGP 4-byte autonomous system numbers from asplain (decimal values) to dot notation.
neighbor remote-as	Adds an entry to the BGP or multiprotocol BGP neighbor table.
network (BGP and multiprotocol BGP)	Specifies the list of networks for the BGP routing process.

router isis

To enable the Intermediate System-to-Intermediate System (IS-IS) routing protocol and to specify an IS-IS process, use the **router isis** command in global configuration mode. To disable IS-IS routing, use the **no** form of this command.

router isis *area-tag*

no router isis *area-tag*

Syntax Description

area-tag	Meaningful name for a routing process. If it is not specified, a null tag is assumed and the process is referenced with a null tag. This name must be unique among all IP or Connectionless Network Service (CLNS) router processes for a given router. Required for multiarea IS-IS configuration. Optional for conventional IS-IS configuration.

Defaults

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	Multiarea functionality was added, changing the way the *tag* argument (now *area-tag*) is used.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is used to enable routing for an area. An appropriate network entity title (NET) must be configured to specify the area address of the area and system ID of the router. Routing must be enabled on one or more interfaces before adjacencies may be established and dynamic routing is possible.

If you have IS-IS running and at least one International Standards Organization Interior Gateway Routing Protocol (ISO-IGRP) process, the IS-IS process and the ISO-IGRP process cannot both be configured without an area tag. The null tag can be used by only one process. If you run ISO-IGRP and IS-IS, a null tag can be used for IS-IS, but not for ISO-IGRP at the same time. However, each area in an IS-IS multiarea configuration should have a nonnull area tag to facilitate identification of the area.

You can configure only one IS-IS routing process to perform Level 2 (interarea) routing. You can configure this process to perform Level 1 (intra-area) routing at the same time. You can configure up to 29 additional processes as Level 1-only processes. If Level 2 routing is configured on any process, all additional processes are automatically configured as Level 1.

An interface cannot be part of more than one area, except in the case where the associated routing process is performing both Level 1 and Level 2 routing. On media such as WAN media where subinterfaces are supported, different subinterfaces could be configured for different areas.

If Level 2 routing is not desired for a given area, use the **is-type** command to remove Level 2. Level 2 routing can then be enabled on some other router instance.

Explicit redistribution between IS-IS instances is prohibited (prevented by the parser). In other words, you cannot issue a **redistribute isis** *area-tag* command in the context of another IS-IS router instance (**router isis** *area-tag*). Redistribution from any other routing protocol into a particular area is possible, and is configured per router instance, as in Cisco IOS software Release 12.0, using the **redistribute** and **route map** commands. By default, redistribution is into Level 2.

If multiple Level 1 areas are defined, the Target Address Resolution Protocol (TARP) behaves in the following way:

- The locally assigned target identifier gets the network service access point (NSAP) of the Level 2 area, if present.
- If only Level 1 areas are configured, the router uses the NSAP of the first active Level 1 area as shown in the configuration at the time of TARP configuration (“tarp run”). (Level 1 areas are sorted alphanumerically by tag name, with capital letters coming before lowercase letters. For example, AREA-1 precedes AREA-2, which precedes area-1.) Note that the target identifier NSAP could change following a reload if a new Level 1 area is added to the configuration after TARP is running.
- The router continues to process all Type 1 and 2 protocol data units (PDUs) that are for this router. Type 1 PDUs are processed locally if the specified target identifier is in the local target identifier cache. If not, they are “propagated” (routed) to all interfaces in the *same* Level 1 area. (The same area is defined as the area configured on the input interface.)
- Type 2 PDUs are processed locally if the specified target identifier is in the local target identifier cache. If not, they are propagated via all interfaces (all Level 1 or Level 2 areas) with TARP enabled. If the source of the PDU is from a different area, the information is also added to the local target identifier cache. Type 2 PDUs are propagated via all static adjacencies.
- Type 4 PDUs (for changes originated locally) are propagated to all Level 1 and Level 2 areas (because internally they are treated as “Level 1-2”).
- Type 3 and 5 PDUs continue to be routed.
- Type 1 PDUs are propagated only via Level 1 static adjacencies if the static NSAP is in one of the Level 1 areas in this router.

After you enter the **router isis** command, you can enter the maximum number of paths. There can be from 1 to 32 paths.

Examples

The following example configures IS-IS for IP routing, with system ID 0000.0000.0002 and area ID 01.0001, and enables IS-IS to form adjacencies on Ethernet interface 0 and serial interface 0. The IP prefix assigned to Ethernet interface 0 will be advertised to other IS-IS routers.

```
router isis tag1
 net 01.0001.0000.0000.0002
 is-type level-1
!
interface ethernet 0
```

```
 ip address 10.1.1.1 255.255.255.0
 ip router isis
!

interface serial 0
 ip unnumbered ethernet0
 ip router isis
```

The following example starts IS-IS routing with the optional *area-tag* argument, where CISCO is the value for the *area-tag* argument:

```
router isis CISCO
```

The following example specifies IS-IS as an IP routing protocol for a process named Finance, and specifies that the Finance process will be routed on Ethernet interface 0 and serial interface 0:

```
router isis Finance
 net 49.0001.aaaa.aaaa.aaaa.00
interface Ethernet 0
 ip router isis Finance
interface serial 0
 ip router isis Finance
```

The following example shows usage of the **maximum-paths** option:

```
router isis
maximum-paths?
20
```

Related Commands

Command	Description
clns router isis	Enables IS-IS routing for ISO CLNS on an interface and attaches an area designator to the routing process.
ip router isis	Configures an IS-IS routing process for IP on an interface and attaches an area designator to the routing process.
net	Configures an IS-IS NET for the routing process.
redistribute (IP)	Redistribute routes from one routing domain into another routing domain.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another.

router ospf

To configure an Open Shortest Path First (OSPF) routing process, use the **router ospf** command in global configuration mode. To terminate an OSPF routing process, use the **no** form of this command.

router ospf *process-id* [**vrf** *vpn-name*]

no router ospf *process-id* [**vrf** *vpn-name*]

Syntax Description

process-id	Internally used identification parameter for an OSPF routing process. It is locally assigned and can be any positive integer. A unique value is assigned for each OSPF routing process.
vrf *vpn-name*	(Optional) Specifies the name of the VPN routing and forwarding (VRF) instance to associate with OSPF VRF processes.

Defaults

No OSPF routing process is defined.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(7)T	The **vrf** keyword and *vpn-name* arguments were added to identify a VPN.
12.0(9)ST	The **vrf** keyword and *vpn-name* arguments were added.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You can specify multiple OSPF routing processes in each router.

After you enter the **router ospf** command, you can enter the maximum number of paths. There can be from 1 to 32 paths.

Examples

The following example configures an OSPF routing process and assign a process number of 109:

```
Router(config)# router ospf 109
```

This example shows a basic OSPF configuration using the **router ospf** command to configure OSPF VRF instance processes for the VRFs first, second, and third:

```
Router> enable
Router# configure terminal
Router(config)# router ospf 12 vrf first
Router(config)# router ospf 13 vrf second
Router(config)# router ospf 14 vrf third
Router(config)# exit
```

The following example shows usage of the **maximum-paths** option:

```
Router> enable
Router# configure terminal
Router(config)# router ospf
Router(config-router)# maximum-paths?
Router(config-router)# 20
Router(config-router)# exit
```

Related Commands

Command	Description
network area	Defines the interfaces on which OSPF runs and defines the area ID for those interfaces.

sabit

To specify the S_{an} status bit used to indicate clock quality level for the Synchronization Status Message (SSM) in synchronous Ethernet, use the **sabit** command in controller configuration mode. To remove a **sabit** configuration, use the **no** form of this command.

sabit ***bit-number***

no sabit ***bit-number***

Syntax Description

bit-number	Specifies the S_a bit used to carry the Synchronization Status Message (SSM). The range is from 4 to 8.

Command Default

4

Command Modes

Controller configuration mode (config-controller)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

When configuring BITS timing using an E1 connection, there are four S_a bits within the packet that can be used to transmit the SSM.

This command only applies to the E1 controller.

Examples

The following partial configuration uses the **sabit** command on a BITS interface with an E1 connection

```
controller BITS
applique E1
framing crc4
ssm
sabit 5
```

Related Commands

Command	Description
ssm	To enable the use of the Synchronization Status Message (SSM) on a synchronous Ethernet connection.

sender-id (CFM-srv)

To indicate the contents of the Sender ID TLV field transmitted in Ethernet connectivity fault management (CFM) messages for the maintenance association, use the **sender-id** command in Ethernet CFM service configuration mode. To send no sender ID information, use the **no** form of this command.

sender-id {**chassis** | **none**}

no sender-id {**chassis** | **none**}

Syntax Description

chassis	Sends only the chassis ID information.
none	No sender ID information is sent.

Command Default

The Sender ID TLV is not included in messages.

Command Modes

Ethernet CFM service configuration (config-ecfm-srv)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command has higher precedence than the **sender-id** command issued for the maintenance domain.

The default is that the enclosing maintenance domain determines the Sender ID.

Examples

The following example shows how to include only the chassis ID information in the Sender ID TLV:

```
Router(config)# ethernet cfm domain customerA level 5
Router(config-ecfm)# service vlan-id 17 port
Router(config-ecfm-srv)# sender-id chassis
```

service (CFM-srv)

To configure a maintenance association within a maintenance domain and place the command-line interface (CLI) into Ethernet connectivity fault management (CFM) service configuration mode (config-ecfm-srv), use the **service** command in Ethernet CFM configuration mode. To remove the configuration, use the **no** form of this command.

service {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]

no service {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]

Syntax Description

ma-name	Short maintenance association name.
ma-num	Integer from 0 to 65535 that identifies the maintenance association.
vlan-id	Configures a primary VLAN.
vlan-id	Integer from 1 to 4094 that identifies the primary VLAN.
vpn-id	Configures a virtual private network (VPN).
vpn-id	Integer from 1 to 32767 that identifies the VPN.
port	(Optional) Configures a DOWN service direction without a VLAN association.
vlan	(Optional) Configures a VLAN.
direction	(Optional) Configures the service direction. The default is “up.”
down	(Optional) Configures the direction toward the LAN.

Command Default

No maintenance associations are configured.

Command Modes

Ethernet CFM configuration (config-ecfm)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This releaes does not support the **vpn-id keyword.**

Usage Guidelines

The maintenance association ID (MAID) is a combination of a maintenance domain ID and the short maintenance association name, and the length of the MAID TLV should not exceed 48 characters.

If you configure the same short maintenance association name for two VLANs in the same domain, an error message is displayed and the command is rejected.

If you specify the service direction as down (outward to the LAN), you can create multiple outward services at the same level containing an overlapping set of VLANs. The set of VLANs in an outward service can also overlap with inward services. A set of VLANs between inward services at the same level must be unique.

Examples

The following example shows how to configure a maintenance association with the ID 10, VLAN 17, and service direction toward the LAN within the customerA maintenance domain:

```
Router(config)# ethernet cfm domain customerA level 5
Router(config-ecfm)# service 10 vlan-id 17 direction down
Router(config-ecfm-srv)#
```

service-policy

To attach a policy map to an input interface, a virtual circuit (VC), an output interface, or a VC that will be used as the service policy for the interface or VC, use the **service-policy** command in the appropriate configuration mode. To remove a service policy from an input or output interface or from an input or output VC, use the **no** form of this command.

service-policy {**input** | **output**} *policy-map-name*

no service-policy {**input** | **output**} *policy-map-name*

Syntax Description

input	Attaches the specified policy map to the input interface or input VC.
output	Attaches the specified policy map to the output interface or output VC.
policy-map-name	The name of a service policy map (created using the **policy-map** command) to be attached. The name can be a maximum of 40 alphanumeric characters.

Command Default

No service policy is specified.
A control policy is not applied to a context.
No policy map is attached.

Command Modes

ATM bundle-VC configuration (config-atm-bundle)
ATM PVP configuration (config-if-atm-l2trans-pvp)
ATM VC mode (config-if-atm-vc)
Global configuration (config)
Interface configuration (config-if)
Map-class configuration (config-map-class)
PVC-in-range configuration (cfg-if-atm-range-pvc)
PVC range subinterface configuration (config-subif)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.0(7)S	This command was integrated into Cisco IOS Release 12.0(7)S.
12.0(17)SL	This command was implemented on the Cisco 10000 series routers.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.1(2)T	This command was modified to enable low latency queueing (LLQ) on Frame Relay VCs.
12.2(14)SX	Support for this command was implemented on Cisco 7600 series routers. This command was changed to support output policy maps.
12.2(15)BX	This command was implemented on the ESR-PRE2.
12.2(17d)SXB	This command was implemented on the Supervisor Engine 2 and integrated into Cisco IOS Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Release	Modification
12.4(2)T	This command was modified to support PVC range subinterface configuration mode and i PVC-in-range configuration mode to extend policy map functionality on an ATM VC to the ATM VC range.
12.4(4)T	The **type stack** and the **type control** keywords were added to support flexible packet matching (FPM).
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series router.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.3(7)XI2	This command was modified to support PVC range configuration mode and PVC-in-range configuration mode for ATM VCs on the Cisco 10000 series router and the Cisco 7200 series router.
12.2(18)ZY	The **type stack** and the **type control** keywords were integrated into Cisco IOS Release 12.2(18)ZY on the Catalyst 6500 series of switches equipped with the Programmable Intelligent Services Accelerator (PISA).
12.2(33)SRC	Support for this command was enhanced on Cisco 7600 series routers.
12.2(33)SB	This command's behavior was modified and implemented on the Cisco 10000 series router for the PRE3 and PRE4.
Cisco IOS XE Release 2.3	This command was modified to support ATM PVP configuration mode.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release does not support the **type access-control** parameter.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the **type access-control** parameter.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Choose the command mode according to the intended use of the command, as follows:

Application	Mode
Standalone VC	VC submode
ATM VC bundle members	Bundle-VC configuration
A range of ATM PVCs	PVC range subinterface configuration
Individual PVC within a PVC range	PVC-in-range configuration
Frame Relay VC	Map-class configuration

You can attach a single policy map to one or more interfaces or to one or more VCs to specify the service policy for those interfaces or VCs.

A service policy specifies class-based weighted fair queueing (CBWFQ). The class policies that make up the policy map are then applied to packets that satisfy the class map match criteria for the class.

To successfully attach a policy map to an interface or ATM VC, the aggregate of the configured minimum bandwidths of the classes that make up the policy map must be less than or equal to 75 percent of the interface bandwidth or the bandwidth allocated to the VC.

Examples

The following example shows how to attach a policy map to a Gigabit Ethernet interface:

```
Router# configure terminal
Router(config)# interface gigabitethernet 0/2
Router(config-if)# service-policy input pmap1
```

The following example attaches the service policy map named “policy9” to the output PVC named “cisco”:

```
Router# configure terminal
Router(config)# pvc cisco 0/5
Router(config-if-atm-vc)# service-policy output policy9
Router(config-if-atm-vc)# vbr-nt 400 200 500
```

Related Commands

Command	Description
class-map	Accesses the QoS class map configuration mode to configure QoS class maps.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

service-policy (class-map)

To attach a policy map to a class, use the **service-policy** command in class-map configuration mode. To remove a service policy from a class, use the **no** form of this command.

service-policy *policy-map*

no service-policy

Syntax Description

policy-map	The name of a service policy map (created using the **policy-map** command) to be attached. The name can be a maximum of 40 alphanumeric characters.

Command Default

No service policy is specified.

Command Modes

Class-map configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You can attach a single policy map to one or more classes to specify the service policy for those classes. This command is only available for the output interface, which is assumed.

Examples

In the following example, three policy maps are defined—cust1-classes, cust2-classes, and cust-policy. The policy maps cust1-classes and cust2-classes have three classes defined—gold, silver, and bronze.

For cust1-classes, gold is configured to use 50 percent of the bandwidth. Silver is configured to use 20 percent of the bandwidth, and bronze is configured to use 15 percent of the bandwidth.

For cust2-classes, gold is configured to use 30 percent of the bandwidth. Silver is configured to use 15 percent of the bandwidth, and bronze is configured to use 10 percent of the bandwidth.

The policy map cust-policy specifies average rate shaping of 384 kbps and assigns the service policy called cust1-classes to the policy map called cust1-classes. The policy map called cust-policy specifies peak rate shaping of 512 kbps and assigns the service policy called cust2-classes to the policy map called cust2-classes.

To configure classes for cust1-classes, use the following commands:

```
Router(config)# policy-map cust1-classes
Router(config-pmap)# class gold
Router(config-pmap-c)# bandwidth percent 50
Router(config-pmap-c)# exit
Router(config-pmap)# class silver
Router(config-pmap-c)# bandwidth percent 20
Router(config-pmap-c)# exit
Router(config-pmap)# class bronze
Router(config-pmap-c)# bandwidth percent 15
```

To configure classes for cust2, use the following commands:

```
Router(config)# policy-map cust2-classes
Router(config-pmap)# class gold
Router(config-pmap-c)# bandwidth percent 30
Router(config-pmap-c)# exit
Router(config-pmap)# class silver
Router(config-pmap-c)# bandwidth percent 15
Router(config-pmap-c)# exit
Router(config-pmap)# class bronze
Router(config-pmap-c)# bandwidth percent 10
```

To define the customer policy with cust1-classes and cust2-classes and QoS features, use the following commands:

```
Router(config)# policy-map cust-policy
Router(config-pmap)# class cust1
Router(config-pmap-c)# shape average 38400
Router(config-pmap-c)# service-policy cust1-classes
Router(config-pmap-c)# exit
Router(config-pmap)# class cust2
Router(config-pmap-c)# shape peak 51200
Router(config-pmap-c)# service-policy cust2-classes
Router(config-pmap-c)# interface e1 0/2
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# exit
Router(config)# interface e10/0
Router(config-if)# service out cust-policy
```

Related Commands

Command	Description
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.

service-policy (policy-map class)

To use a service policy as a QoS policy within a policy map (called a hierarchical service policy), use the **service-policy** command in policy-map class configuration mode. To disable a particular service policy as a QoS policy within a policy map, use the **no** form of this command.

service-policy *policy-map-name*

no service-policy *policy-map-name*

Syntax Description

policy-map-name	Specifies the name of the predefined policy map to be used as a QoS policy. The name can be a maximum of 40 alphanumeric characters.

Command Default

No service policies are used.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is used to create hierarchical service policies in policy-map class configuration mode.

This command is different from the **service-policy** [**input** | **output**] *policy-map-name* command used in interface configuration mode. The purpose of the **service-policy** [**input** | **output**] *policy-map-name* is to attach service policies to interfaces.

The child policy is the previously defined service policy that is being associated with the new service policy through the use of the **service-policy** command. The new service policy using the preexisting service policy is the parent policy.

This command has the following restrictions:

- The **set** command is not supported on the child policy.
- The **priority** command can be used in either the parent or the child policy, but not *both* policies simultaneously.

- The **shape** command can be used in either the parent or the child policy, but not *both* polices simultaneously on a subinterface.
- The **fair-queue** command cannot be defined in the parent policy.
- If the **bandwidth** command is used in the child policy, the **bandwidth** command must also be used in the parent policy. The one exception is for policies using the default class.

Examples

The following example creates a hierarchical service policy in the service policy called parent:

```
Router(config)# policy-map child
Router(config-pmap)# class voice
Router(config-pmap-c)# priority 500
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map parent
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 10000000
Router(config-pmap-c)# service-policy child
```

Related Commands

Command	Description
bandwidth (policy-map class)	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
fair-queue	Specifies the number of queues to be reserved for use by a traffic class.
policy-map	Specifies the name of the service policy to configure.
priority	Gives priority to a class of traffic belonging to a policy map.
service-policy	Specifies the name of the service policy to be attached to the interface.
shape	Specifies average or peak rate traffic shaping.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

service-policy type control

To apply a control policy to a context, use the **service-policy type control** command in the appropriate configuration mode. To remove the control policy, use the **no** form of this command.

service-policy type control *policy-map-name*

no service-policy type control *policy-map-name*

Syntax Description

policy-map-name	Name of the control policy map.

Command Default

A control policy is not applied to a context.

Command Modes

Global configuration
Interface configuration
Subinterface configuration
Virtual template configuration
ATM VC class configuration
ATM VC configuration

Command History

Release	Modification
12.2(28)SB	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

A control policy map must be activated by applying it to a context. A control policy map can be applied to one or more of the following types of contexts:

1. Global
2. Interface
3. Subinterface
4. Virtual template
5. VC class
6. PVC

In general, control policy maps that are applied to more specific contexts take precedence over policy maps applied to more general contexts. In the list, the context types are numbered in order of precedence. For example, a control policy map that is applied to a permanent virtual circuit (PVC) takes precedence over a control policy map that is applied to an interface.

Control policies apply to all sessions hosted on the context.

Only one control policy map may be applied to a given context.

Examples

The following example applies the control policy map "RULEA" to Ethernet interface 0:

```
interface Ethernet 0
 service-policy type control RULEA
```

Related Commands

Command	Description
policy-map type control	Creates or modifies a control policy map, which defines an ISG control policy.

set atm-clp

To set the cell loss priority (CLP) bit when a policy map is configured, use the **set atm-clp** command in policy-map class configuration mode. To remove a specific CLP bit setting, use the **no** form of this command.

set atm-clp

no set atm-clp

Syntax Description

This command has no arguments or keywords.

Command Default

The CLP bit is automatically set to 0 when Cisco routers convert IP packets into ATM cells for transmission through Multiprotocol Label Switching (MPLS)-aware ATM networks.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.
12.2(4)T	This command was implemented on the Cisco MGX 8850 switch and the MGX 8950 switch with a Cisco MGX RPM-PR card.
12.2(4)T2	This command was implemented on the Cisco 7500 series.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB and implemented on the Cisco 10000 series router.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

To disable this command, remove the service policy from the interface.

The **set atm-clp** command works only on platforms that support one of the following adapters: the Enhanced ATM Port Adapter (PA-A3), the ATM Inverse Multiplexer over ATM Port Adapter with eight T1 ports (PA-A3-8T1IMA), or the ATM Inverse Multiplexer over ATM Port Adapter with eight E1 ports (PA-A3-8E1IMA). For more information, refer to the documentation for your specific router.

A policy map containing the **set atm-clp** command can be attached as an output policy only. The **set atm-clp** command does not support packets that originate from the router.

Examples

The following example illustrates setting the CLP bit using the **set atm-clp** command in the policy map:

```
Router(config)# class-map ip-precedence
Router(config-cmap)# match ip precedence 0 1
Router(config-cmap)# exit
Router(config)# policy-map atm-clp-set
Router(config-pmap)# class ip-precedence
Router(config-pmap-c)# set atm-clp
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface atm 1/0/0.1
Router(config-if)# service-policy output policy1
```

Related Commands

Command	Description
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show atm pvc	Displays all ATM PVCs and traffic information.
show policy-map	Displays information about the policy map for an interface.

set cos

To set the Layer 2 class of service (CoS) value of an outgoing packet, use the **set cos** command in policy-map class configuration mode. To remove a specific CoS value setting, use the **no** form of this command.

set cos {*cos-value*}

no set cos {*cos-value*}

Syntax Description

cos-value	Specific IEEE 802.1Q CoS value from 0 to 7.

Command Default

No CoS value is set for the outgoing packet.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.
12.2(13)T	This command was modified for Enhanced Packet Marking to allow a mapping table (table map) to be used to convert and propagate packet-marking values.
12.0(16)BX	This command was implemented on the Cisco 10000 series router for the ESR-PRE2.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB and implemented on the Cisco 10000 series router.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release does not support the *from-field* or **table options.**
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the *from-field* or **table options.**
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

CoS packet marking is supported only in the Cisco Express Forwarding switching path.

The **set cos** command should be used by a router if a user wants to mark a packet that is being sent to a switch. Switches can leverage Layer 2 header information, including a CoS value marking.

The **set cos** command can be used only in service policies that are attached in the output direction of an interface. Packets entering an interface cannot be set with a CoS value.

The **match cos** and **set cos** commands can be used together to allow routers and switches to interoperate and provide quality of service (QoS) based on the CoS markings.

Layer 2 to Layer 3 mapping can be configured by matching on the CoS value because switches already can match and set CoS values. If a packet that needs to be marked to differentiate user-defined QoS services is leaving a router and entering a switch, the router should set the CoS value of the packet because the switch can process the Layer 2 header.

Using This Command with the Enhanced Packet Marking Feature

You can use this command as part of the Enhanced Packet Marking feature to specify the "from-field" packet-marking category to be used for mapping and setting the CoS value. The "from-field" packet-marking categories are as follows:

- Precedence
- Differentiated services code point (DSCP)

If you specify a "from-field" category but do not specify the **table** keyword and the applicable *table-map-nam*e argument, the default action will be to copy the value associated with the "from-field" category as the CoS value. For instance, if you configure the **set cos precedence** command, the precedence value will be copied and used as the CoS value.

You can do the same for the DSCP marking category. That is, you can configure the **set cos dscp** command, and the DSCP value will be copied and used as the CoS value.



Note If you configure the **set cos dscp** command, only the *first three bits* (the class selector bits) of the DSCP field are used.

Examples

In the following example, the policy map called "cos-set" is created to assign different CoS values for different types of traffic. This example assumes that the class maps called "voice" and "video-data" have already been created.

```
Router(config)# policy-map cos-set
Router(config-pmap)# class voice
Router(config-pmap-c)# set cos 1
Router(config-pmap-c)# exit
Router(config-pmap)# class video-data
Router(config-pmap-c)# set cos 2
Router(config-pmap-c)# end
```

Enhanced Packet Marking Example

In the following example, the policy map called "policy-cos" is created to use the values defined in a table map called "table-map1". The table map called "table-map1" was created earlier with the **table-map** (value mapping) command. For more information about the **table-map** (value mapping) command, see the **table-map** (value mapping) command page.

In this example, the setting of the CoS value is based on the precedence value defined in "table-map1":

```
Router(config)# policy-map policy-cos
Router(config-pmap)# class class-default
Router(config-pmap-c)# set cos precedence table table-map1
Router(config-pmap-c)# end
```

Note The **set cos** command is applied when you create a service policy in QoS policy-map configuration mode and attach the service policy to an interface or ATM virtual circuit (VC). For information on attaching a service policy, refer to the "Modular Quality of Service Command-Line Interface Overview" chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Related Commands

Command	Description
match cos	Matches a packet on the basis of Layer 2 CoS marking.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set dscp	Marks a packet by setting the Layer 3 DSCP value in the ToS byte.
set precedence	Sets the precedence value in the packet header.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map class	Displays the configuration for the specified class of the specified policy map.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

set cos-inner

To mark the inner class of service field in a bridged frame, use the **set cos-inner** command in policy-map class configuration mode. To remove marking of the inner CoS field, use the **no** form of this command.

set cos-inner *cos-value*

no set cos-inner *cos-value*

Syntax Description

cos-value	IEEE 802.1q CoS value from 0–7.

Defaults

No default behavior or values.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command was introduced in Cisco IOS Release 12.2(33)SRA to support marking of the inner CoS value when using multipoint bridging (MPB) features on the Enhanced FlexWAN module, and when using MPB features on SPAs with the Cisco 7600 SIP-200 and Cisco 7600 SIP-400 on the Cisco 7600 series router.

This command is not supported on the Cisco 7600 SIP-600.

On the Cisco 7600 SIP-200, this command is not supported with the **set cos** command on the same interface.

For more information about QoS and the forms of marking commands supported by the SIPs on the Cisco 7600 series router, refer to the *Cisco 7600 Series SIP, SSC, and SPA Software Configuration Guide*.

Examples

The following example shows configuration of a QoS class that filters all traffic matching on VLAN 100 into a class named "vlan-inner-100." The configuration shows the definition of a policy-map (also named "vlan-inner-100") that marks the inner CoS with a value of 3 for traffic in the vlan-inner-100 class. Since marking of the inner CoS value is only supported with bridging features, the configuration also shows the service policy being applied as an output policy to a serial SPA interface that bridges traffic into VLAN 100 using the **bridge-domain** command:

```
Router(config)# class-map match-all vlan-inner-100
Router(config-cmap)# match vlan inner 100
Router(config-cmap)# exit
```

```
Router(config)# policy-map vlan-inner-100
Router(config-pmap)# class vlan-inner-100
Router(config-pmap-c)# set cos-inner 3
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface serial3/0/0
Router(config-if)# no ip address
Router(config_if)# encapsulation ppp
Router(config-if)# bridge-domain 100 dot1q
Router(config-if)# service-policy output vlan-inner-100
Router(config-if)# shutdown
Router(config-if)# no shutdown
Router(config-if)# end
```

Related Commands

Command	Description
bridge-domain	Enables RFC 1483 ATM bridging or RFC 1490 Frame Relay bridging to map a bridged virtual LAN (VLAN) to an ATM permanent virtual circuit (PVC) or Frame Relay data-link connection identifier (DLCI).
class-map	Creates a class map to be used for matching packets to a specified class.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
service-policy	Attaches a policy map to an input interface or virtual circuit (VC) or an output interface or VC, to be used as the service policy for that interface or VC.

set cos-inner cos

To copy the outer COS to the inner COS for double-tagged packets, use the **set cos-inner cos** command in policy-map class configuration mode. To remove the outer COS copied to the inner COS for double-tagged packets, use the **no** form of this command.

set cos-inner cos *cos-value*

no set cos-inner cos *cos-value*

Syntax Description

cos-value	IEEE 802.1q CoS value from 0–7.

Defaults

No default behavior or values.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.2(33)SRB	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command was introduced in Cisco IOS Release 12.2(33)SRB and is limited to policies that are applied to the EVC service instances.

For classification, the reference to the outer and inner tags is made to the frames as seen on the wire - that is, for ingress frames, tags prior to the "rewrite", while the for egress, it is after the "rewrite" of the tags, if any.

For marking, the reference to the outer COS at the ingress is to the DBUS-COS and reference to the inner is to the COS in the first tag on the frame; while, at the egress, the reference to outer and inner COS is to the ones in the frame.

Examples

The following example matches on outer COS 3 and 4 and copies the outer COS to the inner COS.

```
Router(config)# class-map cos3_4
Router(config-cmap)# match cos 3 4
Router(config)# policy-map mark-it-in
Router(config-pmap)# class cos3_4
Router(config-pmap-c)# set cos-inner cos
```

Related Commands

Command	Description
bridge-domain	Enables RFC 1483 ATM bridging or RFC 1490 Frame Relay bridging to map a bridged virtual LAN (VLAN) to an ATM permanent virtual circuit (PVC) or Frame Relay data-link connection identifier (DLCI).
class-map	Creates a class map to be used for matching packets to a specified class.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
service-policy	Attaches a policy map to an input interface or virtual circuit (VC) or an output interface or VC, to be used as the service policy for that interface or VC.

set discard-class

To mark a packet with a discard-class value, use the **set discard-class** command in QoS policy-map configuration mode. To prevent the discard-class value of a packet from being altered, use the **no** form of this command.

set discard-class *value*

no set discard-class *value*

Syntax Description

value	Specifies per-hop behavior (PHB) for dropping traffic. The value sets the priority of a type of traffic. Valid values are numbers from 0 to 7.

Command Default

If you do not enter this command, the packet has a discard-class value of 0.

Command Modes

QoS policy-map configuration

Command History

Release	Modification
12.2(13)T	This command was introduced.
12.3(7)XI	This command was implemented on the Cisco 10000 series router for the ESR-PRE2.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The discard class value indicates the discard portion of the PHB. Use the **set discard-class** command only in DiffServ Tunneling Pipe mode. The discard class value is required when the input PHB marking will be used to classify packets on the output interface.

You can also use this command to specify the type of traffic that will be dropped when there is congestion.

Examples

The following example shows that traffic will be set to the discard-class value of 2:

```
set discard-class 2
```

Related Commands

Command	Description
match discard-class	Matches packets of a certain discard class.

set dscp

To mark a packet by setting the differentiated services code point (DSCP) value in the type of service (ToS) byte, use the **set dscp** command in policy-map class configuration mode. To remove a previously set DSCP value, use the **no** form of this command.

set [**ip**] **dscp** {*dscp-value*}

no set [**ip**] **dscp** {*dscp-value*}

Syntax Description

ip	(Optional) Specifies that the match is for IPv4 packets only. If not used, the match is on both IPv4 and IPv6 packets.
dscp-value	A number from 0 to 63 that sets the DSCP value. The following reserved keywords can be specified instead of numeric values: • **EF** (expedited forwarding) • **AF11** (assured forwarding class AF11) • **AF12** (assured forwarding class AF12)

Command Default

Disabled

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.2(13)T	This command was introduced. It replaces the **set ip dscp** command.
12.0(28)S	Support for this command in IPv6 was added on the in Cisco IOS Release 12.0(28)S
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release does not support the *from-field* and **table** options.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the *from-field* and **table** options.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support Weighted Random Early Detection (WRED).

Usage Guidelines

Once the DSCP bit is set, other quality of service (QoS) features can then operate on the bit settings.

DSCP and Precedence Values Are Mutually Exclusive

The **set dscp** command cannot be used with the **set precedence** command to mark the *same* packet. The two values, DSCP and precedence, are mutually exclusive. A packet can have one value or the other, but not both.

Precedence Value and Queueing

The network gives priority (or some type of expedited handling) to marked traffic. Typically, you set the precedence value at the edge of the network (or administrative domain); data then is queued according to the precedence. Weighted fair queueing (WFQ) can speed up handling for high-precedence traffic at congestion points. Weighted Random Early Detection (WRED) ensures that high-precedence traffic has lower loss rates than other traffic during times of congestion.

Use of the "from-field" Packet-marking Category

If you are using this command as part of the Enhanced Packet Marking feature, you can use this command to specify the "from-field" packet-marking category to be used for mapping and setting the DSCP value. The "from-field" packet-marking categories are as follows:

- Class of service (CoS)
- QoS group

If you specify a "from-field" category but do not specify the **table** keyword and the applicable *table-map-nam*e argument, the default action will be to copy the value associated with the "from-field" category as the DSCP value. For instance, if you configure the **set dscp cos** command, the CoS value will be copied and used as the DSCP value.

Note The CoS field is a three-bit field, and the DSCP field is a six-bit field. If you configure the **set dscp cos** command, only the three bits of the CoS field will be used.

If you configure the **set dscp qos-group** command, the QoS group value will be copied and used as the DSCP value.

The valid value range for the DSCP is a number from 0 to 63. The valid value range for the QoS group is a number from 0 to 99. Therefore, when configuring the **set dscp qos-group** command, note the following points:

- If a QoS group value falls within both value ranges (for example, 44), the packet-marking value will be copied and the packets will be marked.
- If QoS group value exceeds the DSCP range (for example, 77), the packet-marking value will not be copied and the packet will not be marked. No action is taken.

Set DSCP Values in IPv6 Environments

When this command is used in IPv6 environments, the default match occurs on both IP and IPv6 packets. However, the actual packets set by this function are only those which meet the match criteria of the class-map containing this function.

Set DSCP Values for IPv6 Packets Only

To set DSCP values for IPv6 values only, the **match protocol ipv6** command must also be used. Without that command, the precedence match defaults to match both IPv4 and IPv6 packets.

Set DSCP Values for IPv4 Packets Only

To set DSCP values for IPv4 packets only, use the **ip** keyword. Without the **ip** keyword, the match occurs on both IPv4 and IPv6 packets.

Examples

Packet-marking Values and Table Map

In the following example, the policy map called "policy1" is created to use the packet-marking values defined in a table map called "table-map1". The table map was created earlier with the **table-map** (value mapping) command. For more information about the **table-map** (value mapping) command, see the table-map (value mapping) command page.

In this example, the DSCP value will be set according to the CoS value defined in the table map called "table-map1".

```
Router(config)# policy-map policy1
Router(config-pmap)# class class-default
Router(config-pmap-c)# set dscp cos table table-map1
Router(config-pmap-c)# end
```

The **set dscp** command is applied when you create a service policy in QoS policy-map configuration mode. This service policy is not yet attached to an interface. For information on attaching a service policy to an interface, refer to the "Modular Quality of Service Command-Line Interface" section of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Related Commands

Command	Description
match protocol	Configures the match criteria for a class map on the basis of the specified protocol.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set cos	Sets the Layer 2 CoS value of an outgoing packet.
set precedence	Sets the precedence value in the packet header.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map class	Displays the configuration for the specified class of the specified policy map.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.
show table-map	Displays the configuration of a specified table map or all table maps.
table-map (value mapping)	Creates and configures a mapping table for mapping and converting one packet-marking value to another.

set fr-de

To change the discard eligible (DE) bit setting in the address field of a Frame Relay frame to 1 for all traffic leaving an interface, use the **set fr-de** command in policy-map class command. To remove the DE bit setting, use the **no** form of this command.

set fr-de

no set fr-de

Syntax Description

This command has no arguments or keywords.

Defaults

The DE bit is usually set to 0. This command changes the DE bit setting to 1.

Command Modes

Policy-map class

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.2(31)SB2	This command was integrated in Cisco IOS Release 12.2(31)SB2, and introduced on the PRE3 for the Cisco 10000 series router.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

To disable this command in a traffic policy, use the **no set fr-de** command in policy-map class configuration mode of the traffic policy.

If the DE bit is already set to 1, no changes are made to the frame.

Examples

The following example shows how to set the DE bit using the **set fr-de** command in the traffic policy. The router sets the DE bit of outbound packets belonging to the ip-precedence class.

```
Router(config)# class-map ip-precedence
Router(config-cmap)# match ip precedence 0 1
Router(config-cmap)# exit
Router(config)# policy-map set-de
Router(config-pmap)# class ip-precedence
Router(config-pmap-c)# set fr-de
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface serial 1/0/0
Router(config-if)# no ip address
Router(config-if)# encapsulation frame-relay
Router(config-if)# interface serial 1/0/0.1
Router(config-subif)# ip address 10.1.1.1 255.255.255.252
Router(config-subif)# no ip directed-broadcast
```

```
Router(config-subif)# service-policy output set-de
```

Related Commands

Command	Description
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.

set ip dscp

The **set ip dscp** command is replaced by the **set dscp** command. See the **set dscp** command for more information.

set ip dscp (policy-map configuration)

To mark a packet by setting the IP differentiated services code point (DSCP) value in the type of service (ToS) byte, use the **set ip dscp** command in policy-map configuration mode. To remove a previously set IP DSCP value, use the **no** form of this command.

set ip dscp *ip-dscp-value*

no set ip dscp *ip-dscp-value*

Syntax Description

ip-dscp-value	IP DSCP value; valid values are from 0 to 63. See the "Usage Guidelines" section for additional information.

Command Default

This command has no default settings.

Command Modes

Policy-map configuration

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	This command was implemented on the Supervisor Engine 2 and integrated into Cisco IOS Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support WRED.

Usage Guidelines

You can enter reserved keywords **EF** (expedited forwarding), **AF11** (assured forwarding class AF11), and **AF12** (assured forwarding class AF12) instead of numeric values for *ip-dscp-value*.

After the IP DSCP bit is set, other quality of service (QoS) features can operate on the bit settings.

You cannot mark a packet by the IP precedence using the **set ip precedence** (policy-map configuration) command and then mark the same packet with an IP DSCP value using the **set ip dscp** command.

The network gives priority (or some type of expedited handling) to marked traffic. Typically, you set IP precedence at the edge of the network (or administrative domain); data is queued based on the precedence. Weighted Fair Queueing (WFQ) can speed up handling for high-precedence traffic at congestion points. Weighted Random Early Detection (WRED) ensures that high-precedence traffic has lower loss rates than other traffic during traffic congestion.

The **set ip precedence** (policy-map configuration) command is applied when you create a service policy in QoS policy-map configuration mode. This service policy is not attached to an interface or to an ATM virtual circuit. See the **service-policy** command for information on attaching a service policy to an interface.

When configuring policy-map class actions, note the following:

- For hardware-switched traffic, Policy Feature Card (PFC) QoS does not support the **bandwidth**, **priority**, **queue-limit**, or **random-detect** policy-map class commands. You can configure these commands because they can be used for software-switched traffic.
- PFC QoS does not support the **set mpls** or **set qos-group** policy-map class commands.
- PFC QoS supports the **set ip dscp** and **set ip precedence** policy-map class commands (see the "Configuring Policy Map Class Marking" section in the *Cisco 7600 Series Router Cisco IOS Software Configuration Guide*).
- You cannot do all three of the following in a policy-map class:
  - Mark traffic with the **set ip dscp** or **set ip precedence** (policy-map configuration) commands
  - Configure the trust state
  - Configure policing

  In a policy-map class, you can either mark traffic with the **set ip dscp** or **set ip precedence** (policy-map configuration) commands or do one or both of the following:
  - Configure the trust state
  - Configure policing

Examples

This example shows how to set the IP DSCP ToS byte to 8 in the policy map called policy1:

```
Router(config)# policy-map policy1
Router(config-cmap)# class class1
Router(config-cmap)# set ip dscp 8
```

All packets that satisfy the match criteria of class1 are marked with the IP DSCP value of 8. How packets that are marked with the IP DSCP value of 8 are treated is determined by the network configuration.

This example shows that after you configure the settings that are shown for voice packets at the edge of the network, all intermediate routers are then configured to provide low-latency treatment to the voice packets:

```
Router(config)# class-map voice
Router(config-cmap)# match ip dscp ef
Router(config)# policy qos-policy
Router(config-cmap)# class voice
Router(config-cmap)# priority 24
```

Related Commands

Command	Description
policy-map	Accesses QoS policy-map configuration mode to configure the QoS policy map.
service-policy	Attaches a policy map to an interface.
show policy-map	Displays information about the policy map.
show policy-map interface	Displays the statistics and the configurations of the input and output policies that are attached to an interface.

set ip dscp tunnel

To set the differentiated services code point (DSCP) value in the tunnel header of a Layer 2 Tunnel Protocol Version 3 (L2TPv3) or Generic Routing Encapsulation (GRE) tunneled packet for tunnel marking, use the **set ip dscp tunnel** command in policy-map class configuration mode. To disable this functionality, use the **no** form of this command.

set ip dscp tunnel *dscp-value*

no set ip dscp tunnel *dscp-value*

Syntax Description

dscp-value	Number from 0 to 63 that identifies the tunnel header value. The following reserved keywords can be specified instead of numeric values: • **EF** (expedited forwarding) • **AF11** (assured forwarding class AF11)

Command Default

The DSCP value is not set.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(28)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRC	This command was integrated into Cisco IOS Release 12.2(33)SRC.
12.4(15)T2	This command was integrated into Cisco IOS Release 12.4(15)T2, and support for marking GRE-tunneled packets was included. **Note** For this release, marking GRE-tunneled packets is supported only on platforms equipped with a Cisco MGX Route Processor Module (RPM-XF).
12.2(33)SB	Support for marking GRE-tunneled packets was included, and support for the Cisco 7300 series router was added.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

It is possible to configure L2TPv3 (or GRE) tunnel marking and the **ip tos** command at the same time. However, Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC) (L2TPv3 or GRE) tunnel marking has higher priority over **ip tos** commands, meaning that tunnel marking always rewrites the IP header of the tunnel packet and overwrites the values set by **ip tos** commands. The order of enforcement is as follows when these commands are used simultaneously:

1. **set ip dscp tunnel** or **set ip precedence tunnel** (L2TPv3 or GRE tunnel marking)

2. **ip tos reflect**
3. **ip tos** *tos-value*

This is the designed behavior. We recommend that you configure only L2TPv3 (or GRE) tunnel marking and reconfigure any peers configured with the **ip tos** command to use L2TPv3 (or GRE) tunnel marking.

Note For Cisco IOS Release 12.4(15)T2, marking GRE-tunneled packets is supported only on platforms equipped with a Cisco RPM-XF.

Examples

The following example shows the **set ip dscp tunnel** command used in a tunnel marking configuration. In this example, a class map called "class-cl" has been configured to match traffic on the basis of the Frame Relay discard eligible (DE) bit setting. Also, a policy map called "policy1" has been created within which the **set ip dscp tunnel** command has been configured.

```
Router> enable
Router# configure terminal
Router(config)# class-map class-c1
Router(config-cmap)# match fr-de
Router(config-cmap)# exit
Router(config)# policy-map policy1
Router(config-pmap)# class tunnel
Router(config-pmap-c)# set ip dscp tunnel 5
Router(config-pmap-c)# end
```

Note You must still attach a policy map to an interface or ATM PVC using the **service-policy** command. Policy maps with this tunnel marking are not accepted in the output direction. For more information about attaching a policy map to an interface or ATM PVC, see the "Applying QoS Features Using the MQC" module of the *Cisco IOS Quality of Service Solutions Configuration Guide.*

Related Commands

Command	Description
ip tos	Specifies the ToS level for IP traffic.
set ip precedence tunnel	Sets the precedence value in the header of an L2TPv3 or GRE tunneled packet.

set ip precedence (policy-map configuration)

To set the precedence value in the IP header, use the **set ip precedence** command in policy-map configuration mode. To leave the precedence value at the current setting, use the **no** form of this command.

set ip precedence *ip-precedence-value*

no set ip precedence

Syntax Description

ip-precedence-value	Precedence-bit value in the IP header; valid values are from 0 to 7. See Table 1-10 for a list of value definitions.

Command Default

This command is disabled by default.

Command Modes

Policy-map configuration

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	This command was implemented on the Supervisor Engine 2 and integrated into Cisco IOS Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support Weighted Random Early Detection (WRED).

Usage Guidelines

Table 1-10 lists the value definitions for precedence values in the IP header. They are listed from least to most important.

Table 1-10 Value Definitions for IP Precedence

Values	Definitions
0	routine
1	priority
2	immediate
3	flash
4	flash-override
5	critical

Table 1-10 Value Definitions for IP Precedence

6	internet
7	network

After the IP precedence bits are set, other quality of service (QoS) features, such as Weighted Fair Queueing (WFQ) and Weighted Random Early Detection (WRED), operate on the bit settings.

The network priorities (or some type of expedited handling) mark traffic through the application of WFQ or WRED at points downstream in the network. Typically, you set IP precedence at the edge of the network (or administrative domain); data is queued based on the precedence. WFQ can speed up handling for certain precedence traffic at congestion points. WRED can ensure that certain precedence traffic has lower loss rates than other traffic during traffic congestion.

The **set ip precedence** command is applied when you create a service policy in policy-map configuration mode. This service policy is not attached to an interface or to an ATM virtual circuit. See the **service-policy** command for information on attaching a service policy to an interface.

Examples

This example shows how to set the IP precedence to 5 for packets that satisfy the match criteria of the class map called class1:

```
Router(config)# policy-map policy1
Router(config-pmap)# class class1
Router(config-pmap-c)# set ip precedence 5
```

All packets that satisfy the match criteria of class1 are marked with the IP precedence value of 5. How packets that are marked with the IP-precedence value of 5 are treated is determined by the network configuration.

Related Commands

Command	Description
policy-map	Accesses QoS policy-map configuration mode to configure the QoS policy map.
service-policy	Attaches a policy map to an interface.
show policy-map	Displays information about the policy map.
show policy-map interface	Displays the statistics and the configurations of the input and output policies that are attached to an interface.

set ip precedence (policy-map)

The **set ip precedence** (policy-map) command is replaced by the **set precedence** command. See the **set precedence** command for more information.

set ip precedence (route-map)

To set the precedence value (and an optional IP number or IP name) in the IP header, use the **set ip precedence** command in route-map configuration mode. To leave the precedence value unchanged, use the **no** form of this command.

set ip precedence [*number* | *name*]

no set ip precedence

Syntax Description

number | *name*	(Optional) A number or name that sets the precedence bits in the IP header. The values for the *number* argument and the corresponding *name* argument are listed in Table 1-11 from least to most important.

Command Default

Disabled

Command Modes

Route-map configuration

Command History

Release	Modification
11.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Table 1-11 lists the values for the *number* argument and the corresponding *name* argument for precedence values in the IP header. They are listed from least to most important.

Table 1-11 Number and Name Values for IP Precedence

Number	Name
0	**routine**
1	**priority**
2	**immediate**
3	**flash**
4	**flash-override**
5	**critical**

Table 1-11 Number and Name Values for IP Precedence

6	**internet**
7	**network**

You can set the precedence using either a number or the corresponding name. Once the IP Precedence bits are set, other QoS services such as weighted fair queueing (WFQ) then operate on the bit settings.

The network gives priority (or some type of expedited handling) to marked traffic through the application of WFQ at points downstream in the network. Typically, you set IP Precedence at the edge of the network (or administrative domain); data then is queued based on the precedence. WFQ can speed up handling for certain precedence traffic at congestion points. WRED can ensure that certain precedence traffic has lower loss rates than other traffic during times of congestion.

Note Release 15.0(1)MR does not support WRED.

The mapping from arguments such as **routine** and **priority** to a precedence value is useful only in some instances. That is, the use of the precedence bit is evolving. You can define the meaning of a precedence value by enabling other features that use the value. In the case of the high-end Internet QoS available from Cisco, IP Precedences can be used to establish classes of service that do not necessarily correspond numerically to better or worse handling in the network.

Use the **route-map** (IP) global configuration command with the **match** and **set** route-map configuration commands to define the conditions for redistributing routes from one routing protocol into another, or for policy routing. Each **route-map** command has an associated list of **match** and **set** commands. The **match** commands specify the match criteria—the conditions under which redistribution or policy routing is allowed for the current **route-map** command. The **set** commands specify the set actions—the particular redistribution or policy routing actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route-map configuration commands specify the redistribution set actions to be performed when all of the match criteria of a route map are met.

Examples

The following example sets the IP Precedence to 5 (critical) for packets that pass the route map match:

```
interface serial 0
 ip policy route-map texas

route-map texas
match length 68 128
set ip precedence 5
```

Related Commands

Command	Description
random-detect dscp	Changes the minimum and maximum packet thresholds for the DSCP value.

set ip precedence tunnel

To set the precedence value in the header of a Layer 2 Tunnel Protocol Version 3 (L2TPv3) or Generic Routing Encapsulation (GRE) tunneled packet for tunnel marking, use the **set ip precedence tunnel** command in policy-map class configuration mode. To disable this functionality, use the **no** form of this command.

set ip precedence tunnel ***precedence****-value*

no set ip precedence tunnel *precedence-value*

Syntax Description

precedence-value	Number from 0 to 7 that identifies the precedence value of the tunnel header.

Command Default

The precedence value is not set.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(28)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRC	This command was integrated into Cisco IOS Release 12.2(33)SRC.
12.4(15)T2	This command was integrated into Cisco IOS Release 12.4(15)T2, and support for marking GRE-tunneled packets was included. **Note** For this release, marking GRE-tunneled packets is supported only on platforms equipped with a Cisco MGX Route Processor Module (RPM-XF).
12.2(33)SB	Support for marking GRE-tunneled packets was included, and support for the Cisco 7300 series router was added.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

It is possible to configure L2TPv3 (or GRE) tunnel marking and the **ip tos** command at the same time. However, Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC) (L2TPv3 or GRE) tunnel marking has higher priority over **ip tos** commands, meaning that tunnel marking always rewrites the IP header of the tunnel packet and overwrites the values set by **ip tos** commands. The order of enforcement is as follows when these commands are used simultaneously:

1. **set ip dscp tunnel** or **set ip precedence tunnel** (L2TPv3 or GRE tunnel marking)
2. **ip tos reflect**
3. **ip tos** *tos-value*

This is the designed behavior. We recommend that you configure only L2TPv3 (or GRE) tunnel marking and reconfigure any peers configured with the **ip tos** command to use L2TPv3 (or GRE) tunnel marking.

Note For Cisco IOS Release 12.4(15)T2, marking GRE-tunneled packets is supported only on platforms equipped with a Cisco RPM-XF.

Examples

The following example shows the **set ip precedence tunnel** command used in a tunnel marking configuration. In this example, a class map called "MATCH_FRDE" has been configured to match traffic on the basis of the Frame Relay discard eligible (DE) bit setting. Also, a policy map called "policy1" has been created within which the **set ip precedence tunnel** command has been configured.

```
Router> enable
Router# configure terminal
Router(config)# class-map MATCH_FRDE
Router(config-cmap)# match fr-de
Router(config-cmap)# exit
Router(config)# policy-map policy1
Router(config-pmap)# class tunnel
Router(config-pmap-c)# set ip precedence tunnel 7
Router(config-pmap-c)# end
```

Note You must still attach a policy map to an interface or ATM PVC using the **service-policy** command. Policy maps with this tunnel marking are not accepted in the output direction. For more information about attaching a policy map to an interface or ATM PVC, see the "Applying QoS Features Using the MQC" module of the *Cisco IOS Quality of Service Solutions Configuration Guide.*

Related Commands

Command	Description
ip tos	Specifies the ToS level for IP traffic in the TN3270 server.
set ip dscp tunnel	Sets the DSCP value in the header of an L2TPv3 tunneled packet.

set ip tos (route-map)

To set the type of service (ToS) bits in the header of an IP packet, use the **set ip tos** command in route-map configuration mode. To leave the ToS bits unchanged, use the **no** form of this command.

set ip tos [*tos-bit-value* | **max-reliability** | **max-throughput** | **min-delay** | **min-monetary-cost** | **normal**]

no set ip tos

Syntax Description

tos-bit-value	(Optional) A value (number) from 0 to 15 that sets the ToS bits in the IP header. See Table 1-12 for more information.
max-reliability	(Optional) Sets the maximum reliability ToS bits to 2.
max-throughput	(Optional) Sets the maximum throughput ToS bits to 4.
min-delay	(Optional) Sets the minimum delay ToS bits to 8.
min-monetary-cost	(Optional) Sets the minimum monetary cost ToS bits to 1.
normal	(Optional) Sets the normal ToS bits to 0.

Command Default

Disabled

Command Modes

Route-map configuration

Command History

Release	Modification
11.2	This command was introduced.
12.4T	This command was integrated into Cisco IOS Release 12.4T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command allows you to set four bits in the ToS byte header. Table 1-12 shows the format of the four bits in binary form.

Table 1-12 ToS Bits and Description

T3	T2	T1	T0	Description
0	0	0	0	0 normal forwarding
0	0	0	1	1 minimum monetary cost

Table 1-12 ToS Bits and Description (continued)

0	0	1	0	2 maximum reliability
0	1	0	0	4 maximum throughput
1	0	0	0	8 minimum delay

The T3 bit sets the delay. Setting T3 to 0 equals normal delay, and setting it to 1 equals low delay.

The T2 bit sets the throughput. Setting this bit to 0 equals normal throughput, and setting it to 1 equals maximum throughput. Similarly, the T1 and T0 bits set reliability and cost, respectively. Therefore, as an example, if you want to set a packet with the following requirements:

minimum delay T3 = 1

normal throughput T2 = 0

normal reliability T1 = 0

minimum monetary cost T0 = 1

You would set the ToS to 9, which is 1001 in binary format.

Use the **route-map** (IP) global configuration command with the **match** and **set** (route-map) configuration commands to define the conditions for redistributing routes from one routing protocol into another, or for policy routing. Each **route-map** command has an associated list of **match** and **set** commands. The **match** commands specify the match criteria—the conditions under which redistribution or policy routing is allowed for the current route-map command. The **set** commands specify the set actions—the particular redistribution or policy routing actions to perform if the criteria enforced by the match commands are met. The **no route-map** command deletes the route map.

The **set** (route-map) commands specify the redistribution set actions to be performed when all of the match criteria of a route map are met.

Examples

The following example sets the IP ToS bits to 8 (minimum delay as shown in Table 1-12) for packets that pass the route-map match:

```
interface serial 0
 ip policy route-map texas
!
route-map texas
  match length 68 128
  set ip tos 8
!
```

Related Commands

Command	Description
ip policy route-map	Identifies a route map to use for policy routing on an interface.
route-map (IP)	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.

set network-clocks

This command causes the router to reselect a network clock; the router selects a new clock based on clock priority.

set network-clocks [force-reselect | next-select]

Syntax Description

force-reselect	Forces the router to select a new network clock.
next-select	Forces the router to select the next available network clock.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the set network-clocks force-reselect command:

```
Router# set network-clocks force-reselect
```

Related Commands

Command	Description
show network-clocks	Displays information about all clocks configured on the router.

set precedence

To set the precedence value in the packet header, use the **set precedence** command in policy-map class configuration mode. To remove the precedence value, use the **no** form of this command.

set precedence {*precedence-value*}

no set precedence {*precedence-value*}

Syntax Description

precedence-value	A number from 0 to 7 that sets the precedence bit in the packet header.

Command Default

Disabled

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.2(13)T	This command was introduced. This command replaces the **set ip precedence** command.
12.0(28)S	Support for this command in IPv6 was added in Cisco IOS Release 12.0(28)S on the Cisco 12000 series Internet routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB and implemented on the Cisco 10000 series router.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release does not support the *from-field* and **table** options.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the *from-field* and **table** options.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support Weighted Random Early Detection (WRED).

Usage Guidelines

Command Compatibility

If a router is loaded with an image that contained an old configuration, the **set ip precedence** command is still recognized. However, the **set precedence** command will be used in place of the **set ip precedence** command.

The **set precedence** command cannot be used with the **set dscp** command to mark the *same* packet. The two values, DSCP and precedence, are mutually exclusive. A packet can be one value or the other, but not both.

Bit Settings

Once the precedence bits are set, other quality of service (QoS) features such as weighted fair queueing (WFQ) and Weighted Random Early Detection (WRED) then operate on the bit settings.

Precedence Value

The network gives priority (or some type of expedited handling) to marked traffic through the application of WFQ or WRED at points downstream in the network. Typically, you set the precedence value at the edge of the network (or administrative domain); data then is queued according to the specified precedence. WFQ can speed up handling for certain precedence traffic at congestion points. WRED can ensure that certain precedence traffic has lower loss rates than other traffic during times of congestion.

The **set precedence** command cannot be used with the **set dscp** command to mark the *same* packet. The two values, differentiated services code point (DSCP) and precedence, are mutually exclusive. A packet can have one value or the other, but not both.

Using This Command with the Enhanced Packet Marking Feature

If you are using this command as part of the Enhanced Packet Marking feature, you can use this command to specify the "from-field" packet-marking category to be used for mapping and setting the precedence value. The "from-field" packet-marking categories are as follows:

- CoS
- QoS group

If you specify a "from-field" category but do not specify the **table** keyword and the applicable *table-map-nam*e argument, the default action will be to copy the value associated with the "from-field" category as the precedence value. For instance, if you configure the **set precedence cos** command, the CoS value will be copied and used as the precedence value.

You can do the same for the QoS group-marking category. That is, you can configure the **set precedence qos-group** command, and the QoS group value will be copied and used as the precedence value.

The valid value range for the precedence value is a number from 0 to 7. The valid value range for the QoS group is a number from 0 to 99. Therefore, when configuring the **set precedence qos-group** command, note the following points:

- If a QoS group value falls within both value ranges (for example, 6), the packet-marking value will be copied and the packets will be marked.
- If QoS group value exceeds the precedence range (for example, 10), the packet-marking value will not be copied, and the packet will not be marked. No action is taken.

Setting Precedence Values for IPv4 Packets Only

To set the precedence values for IPv4 packets only, use a command involving the **ip** keyword like the **match ip precedence** or **match ip dscp** command or include the **match protocol ip** command along with the others in the class map. Without the additional **ip** keyword, the class-map may match both IPv6 and IPv4 packets (depending on the other match criteria) and the **set precedence** or **set dscp** command may act upon both types of packets.

Examples

The following example shows how to use the set precedence command.

```
Router(config)# policy-map policy-cos
Router(config-pmap)# class class-default
Router(config-pmap-c)# set precedence 4
Router(config-pmap-c)# end
```

The **set precedence** command is applied when you create a service policy in QoS policy-map configuration mode. This service policy is not yet attached to an interface or to an ATM virtual circuit. For information on attaching a service policy to an interface, refer to the "Modular Quality of Service Command-Line Interface Overview" chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide.*

Related Commands

Command	Description
match dscp	Identifies a specific IP DSCP value as a match criterion.
match precedence	Identifies IP precedence values as match criteria.
match protocol	Configures the match criteria for a class map on the basis of the specified protocol.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
set cos	Sets the Layer 2 CoS value of an outgoing packet.
set dscp	Marks a packet by setting the Layer 3 DSCP value in the ToS byte.
set qos-group	Sets a group ID that can be used later to classify packets.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the configuration for all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.
show table-map	Displays the configuration of a specified table map or all table maps.
table-map (value mapping)	Creates and configures a mapping table for mapping and converting one packet-marking value to another.

set qos-group

To set a quality of service (QoS) group identifier (ID) that can be used later to classify packets, use the **set qos-group** command in policy-map class configuration mode. To remove the group ID, use the **no** form of this command.

set qos-group {*group-id*}

no set qos-group {*group-id*}

Syntax Description

group-id	Group ID number in the range from 0 to 99.

Command Default

No group ID is specified.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
11.1CC	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.0(17)SL	This command was introduced on the Cisco 10000 series router.
12.2(13)T	This command can now be used with the **random-detect discard-class-based** command, and this command was modified for the Enhanced Packet Marking feature. A mapping table (table map) can now be used to convert and propagate packet-marking values.
12.2(18)SXE	This command was integrated into Cisco IOS 12.2(18)SXE, and the **cos** keyword was added.
12.2(31)SB	This command was integrated into Cisco IOS Release 12.2(31)SB.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR. This release does not support the *from-field and* **table options.**
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the *from-field and* **table options.**
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support WRED.

Usage Guidelines

The **set qos-group** command allows you to associate a group ID with a packet. The group ID can be used later to classify packets into QoS groups based as prefix, autonomous system, and community string.

A QoS group and discard class are required when the input per-hop behavior (PHB) marking will be used for classifying packets on the output interface.

Using This Command with the Enhanced Packet Marking Feature

If you are using this command as part of the Enhanced Packet Marking feature, you can use this command to specify the "from-field" packet-marking category to be used for mapping and setting the precedence value.

If you specify a "from-field" category but do not specify the **table** keyword and the applicable *table-map-name* argument, the default action will be to copy the value associated with the "from-field" category as the precedence value. For instance, if you enter **set qos-group precedence**, the precedence value will be copied and used as the QoS group value.

A packet is marked with a QoS group value only while it is being processed within the router. The QoS group value is not included in the packet's header when the packet is transmitted over the output interface. However, the QoS group value can be used to set the value of a Layer 2 or Layer 3 field that is included as part of the packet's headers (such as the MPLS EXP, CoS, and DSCP fields).

Note The **set qos-group cos** and **set qos-group precedence** commands are equivalent to the **mls qos trust cos** and **mls qos trust prec** commands.

Tip The **set qos-group** command cannot be applied until you create a service policy in policy-map configuration mode and then attach the service policy to an interface or ATM virtual circuit (VC). For information on attaching a service policy, refer to the "Modular Quality of Service Command-Line Interface Overview" chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Examples

The following example shows how to set the QoS group to 1 for all packets that match the class map called class 1. These packets are then rate limited on the basis of the QoS group ID.

```
Router(config)# policy-map policy1
Router(config-pmap)# class class1
Router(config-pmap-c)# set qos-group 1
Router(config-pmap-c)# end
```

The following example shows how to set the QoS group value based on the packet's original 802.1P CoS value:

```
Router(config)# policy map policy1
Router(config-pmap)# class class-default
Router(config-pmap-c)# set qos-group cos
Router(config-pmap-c)# end
```

Enhanced Packet Marking Example

The following example shows how to set the QoS group value based on the values defined in a table map called table-map1. This table map is configured in a policy map called policy1. Policy map policy1 converts and propagates the QoS value according to the values defined in table-map1.

In this example, the QoS group value will be set according to the precedence value defined in table-map1.

```
Router(config)# policy map policy1
Router(config-pmap)# class class-default
Router(config-pmap-c)# set qos-group precedence table table-map1
Router(config-pmap-c)# end
```

Related Commands

Command	Description
match input vlan	Configures a class map to match incoming packets that have a specific VLAN ID.
match qos-group	Identifies a specified QoS group value as a match criterion.
mls qos trust	Sets the trusted state of an interface to determine which incoming QoS field on a packet, if any, should be preserved.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

shape

To specify average or peak rate traffic shaping, use the **shape** command in class-map configuration mode. To remove traffic shaping, use the **no** form of this command.

shape {**average** | **peak**} *cir* [*bc*] [*be*]

no shape {**average** | **peak**} *cir* [*bc*] [*be*]

Syntax Description

average	Specifies average rate shaping.
peak	Specifies peak rate shaping.
cir	Specifies the committed information rate (CIR), in bits per second (bps). For a committed (average) burst rate, valid values are 30,000–10,000,000,000. For an excess (peak) burst rate, valid values are 8,000-10,000,000,000.
bc	(Optional) Specifies the Committed Burst size, in bits.
be	(Optional) Specifies the Excess Burst size, in bits.

Command Default

Average or peak rate traffic shaping is not specified.

Command Modes

Class-map configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Traffic shaping limits the rate of transmission of data. In addition to using a specifically configured transmission rate, you can use Generic Traffic Shaping (GTS) to specify a derived transmission rate based on the level of congestion.

You can specify two types of traffic shaping; average rate shaping and peak rate shaping. Average rate shaping limits the transmission rate to the CIR. Using the CIR ensures that the average amount of traffic being sent conforms to the rate expected by the network.

Peak rate shaping configures the router to send more traffic than the CIR. To determine the peak rate, the router uses the following formula:

peak rate = CIR(1 + Be / Bc)

where:

- Be is the Excess Burst size.
- Bc is the Committed Burst size.

Peak rate shaping allows the router to burst higher than average rate shaping. However, using peak rate shaping, the traffic sent above the CIR (the delta) could be dropped if the network becomes congested.

If your network has additional bandwidth available (over the provisioned CIR) and the application or class can tolerate occasional packet loss, that extra bandwidth can be exploited through the use of peak rate shaping. However, there may be occasional packet drops when network congestion occurs. If the traffic being sent to the network must strictly conform to the configured network provisioned CIR, then you should use average traffic shaping.

Examples

The following example sets the uses average rate shaping to ensure a bandwidth of 256 kbps:

```
shape average 256000
```

The following example uses peak rate shaping to ensure a bandwidth of 300 kbps but allow throughput up to 512 kbps if enough bandwidth is available on the interface:

```
bandwidth 300
shape peak 512000
```

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
shape max-buffers	Specifies the maximum number of buffers allowed on shaping queues.

shape (percent)

To specify average or peak rate traffic shaping on the basis of a percentage of bandwidth available on an interface, use the **shape** command in policy-map class configuration mode. To remove traffic shaping, use the **no** form of this command.

shape {**average** | **peak**} **percent** *percentage* [*sustained-burst-in-msec* **ms**] [**be** *excess-burst-in-msec* **ms**] [**bc** *committed-burst-in-msec* **ms**]

no shape {**average** | **peak**} **percent** *percentage* [*sustained-burst-in-msec* **ms**] [**be** *excess-burst-in-msec* **ms**] [**bc** *committed-burst-in-msec* **ms**]

Syntax Description

average	Specifies average rate traffic shaping.
peak	Specifies peak rate traffic shaping.
percent	Specifies that a percent of bandwidth will be used for either the average rate traffic shaping or peak rate traffic shaping.
percentage	Specifies the bandwidth percentage. Valid range is a number from 1 to 100.
sustained-burst-in-msec	(Optional) Sustained burst size used by the first token bucket for policing traffic. Valid range is a number from 4 to 200.
ms	(Optional) Indicates that the burst value is specified in milliseconds (ms).
be	(Optional) Excess burst (be) size used by the second token bucket for policing traffic.
excess-burst-in-msec	(Optional) Specifies the be size in milliseconds. Valid range is a number from 0 to 200.
bc	(Optional) Committed burst (bc) size used by the first token bucket for policing traffic.
committed-burst-in-msec	(Optional) Specifies the bc value in milliseconds. Valid range is a number from 1 to 2000.

Command Default

The default bc and be is 4 ms.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.1(2)T	This command was introduced.
12.2(13)T	This command was modified for the Percentage-Based Policing and Shaping feature.
12.0(28)S	The command was integrated into Cisco IOS Release 12.0(28)S.
12.2(18)SXE	The command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(28)SB	The command was integrated into Cisco IOS Release 12.2(28)SB.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Committed Information Rate

This command calculates the committed information rate (CIR) on the basis of a percentage of the available bandwidth on the interface. Once a policy map is attached to the interface, the equivalent CIR value in bits per second (bps) is calculated on the basis of the interface bandwidth and the percent value entered with this command. The **show policy-map interface** command can then be used to verify the CIR bps value calculated.

The calculated CIR bps rate must be in the range of 8000 and 154,400,000 bps. If the rate is less than 8000 bps, the associated policy map cannot be attached to the interface. If the interface bandwidth changes (for example, more is added), the CIR bps values are recalculated on the basis of the revised amount of bandwidth. If the CIR percentage is changed after the policy map is attached to the interface, the bps value of the CIR is recalculated.

Conform Burst and Peak Burst Sizes in Milliseconds

This command also allows you to specify the values for the conform burst size and the peak burst size in milliseconds. If you want bandwidth to be calculated as a percentage, the conform burst size and the peak burst size must be specified in milliseconds (ms).

The traffic shape converge rate depends on the traffic pattern and the time slice (Tc) parameter, which is directly affected by the bc that you configured. The Tc and the average rate configured are used to calculate bits per interval sustained. Therefore, to ensure that the shape rate is enforced, use a bc that results in a Tc greater than 10 ms.

How Bandwidth Is Calculated

The **shape** (percent) command is often used in conjunction with the **bandwidth** and **priority** commands. The **bandwidth** and **priority** commands can be used to calculate the total amount of bandwidth available on an entity (for example, a physical interface). When the **bandwidth** and **priority** commands calculate the total amount of bandwidth available on an entity, the following guidelines are invoked:

- If the entity is a physical interface, the total bandwidth is the bandwidth on the physical interface.
- If the entity is a shaped ATM permanent virtual circuit (PVC), the total bandwidth is calculated as follows:
  - For a variable bit rate (VBR) virtual circuit (VC), the sustained cell rate (SCR) is used in the calculation.
  - For an available bit rate (ABR) VC, the minimum cell rate (MCR) is used in the calculation.

For more information on bandwidth allocation, see the "Congestion Management Overview" chapter in the *Cisco IOS Quality of Service Solutions Configuration Guide.*

Examples

The following example configures traffic shaping using an average shaping rate on the basis of a percentage of bandwidth. In this example, 25 percent of the bandwidth has been specified. Additionally, an optional be value and bc value (100 ms and 400 ms, respectively) have been specified.

```
Router> enable
Router# configure terminal
Router(config)# policy-map policy1
```

```
Router(config-pmap)# class-map class1
Router(config-pmap-c)# shape average percent 25 20 ms be 100 ms bc 400 ms
Router(config-pmap-c)# end
```

After the policy map and class maps are configured, the policy map is attached to interface as shown in the following example.

```
Router> enable
Router# configure terminal
Router(config)# interface serial4/0
Router(config-if)# service-policy input policy1
Router(config-if)# end
```

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
class (policy-map)	Specifies the name of the class whose policy you want to create or change and the default class (commonly known as the class-default class) before you configure its policy.
police (percent)	Configures traffic policing on the basis of a percentage of bandwidth available on an interface.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
priority	Gives priority to a class of traffic belonging to a policy map.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
shape max-buffers	Specifies the maximum number of buffers allowed on shaping queues.
show policy-map interface	Displays the statistics and the configurations of the input and output policies that are attached to an interface.

shape (policy-map class)

To shape traffic to the indicated bit rate according to the algorithm specified, or to enable ATM overhead accounting, use the **shape** command in policy-map class configuration mode. To remove shaping and leave the traffic unshaped, use the **no** form of this command.

shape [**average** | **peak**] *mean-rate* [*burst-size*] [*excess-burst-size*]

no shape [**average** | **peak**]

Syntax Description

average	(Optional) Committed Burst (Bc) is the maximum number of bits sent out in each interval.
peak	(Optional) Bc + Excess Burst (Be) is the maximum number of bits sent out in each interval.
mean-rate	(Optional) Also called committed information rate (CIR). Indicates the bit rate used to shape the traffic, in bits per second. When this command is used with backward explicit congestion notification (BECN) approximation, the bit rate is the upper bound of the range of bit rates that will be permitted. For a committed (average) burst rate, valid values are 30,000–10,000,000,000. For an excess (peak) burst rate, valid values are 8,000-10,000,000,000.
burst-size	(Optional) The number of bits in a measurement interval (Bc).
excess-burst-size	(Optional) The acceptable number of bits permitted to go over the Be.

Command Default

When the excess burst size (Be) is not configured, the default Be value is equal to the committed burst size (Bc). For more information about burst size defaults, see the "Usage Guidelines" section.

Traffic shaping overhead accounting for ATM is disabled.

Command Modes

Policy-map class configuration (config-pmap-c)

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.0(17)SL	This command was integrated into Cisco IOS Release 12.0(17)SL and implemented on the PRE1 for the Cisco 10000 series router.
12.2(16)BX	This command was integrated into Cisco IOS Release 12.2(16)BX and implemented on the PRE2 for the Cisco 10000 series router.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(31)SB2	This command was enhanced for ATM overhead accounting and implemented on the Cisco 10000 series router for the PRE3.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Release	Modification
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(31)SB6	This command was enhanced to specify an offset size when calculating ATM overhead and implemented on the Cisco 10000 series router for the PRE3.
12.2(33)SRC	Support for the Cisco 7600 series router was added.
12.2(33)SB	Support for the Cisco 7300 series router was added.
Cisco IOS XE Release 2.1	This command was implemented on Cisco ASR 1000 series routers
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The measurement interval is the committed burst size (Bc) divided by committed information rate (CIR). Bc cannot be set to 0. If the measurement interval is too large (greater than 128 milliseconds), the system subdivides it into smaller intervals.

If you do not specify the committed burst size (Bc) and the excess burst size (Be), the algorithm decides the default values for the shape entity. The algorithm uses a 4 milliseconds measurement interval, so Bc is CIR * (4 / 1000).

Burst sizes larger than the default committed burst size (Bc) need to be explicitly specified. The larger the Bc, the longer the measurement interval. A long measurement interval may affect voice traffic latency, if applicable.

When the excess burst size (Be) is not configured, the default value is equal to the committed burst size (Bc).

Examples

The following example configures a shape entity with a CIR of 1 Mbps and attaches the policy map called dts-interface-all-action to interface pos1/0/0:

```
policy-map dts-interface-all-action
 class class-interface-all
  shape average 1000000

interface pos1/0/0
 service-policy output dts-interface-all-action
```

Traffic Shaping Overhead Accounting for ATM

When a parent policy has ATM overhead accounting enabled for shaping, you are not required to enable accounting at the child level using the **police** command. In the following configuration example, ATM overhead accounting is enabled for bandwidth on the gaming and class-default class of the child policy map named subscriber_classes and on the class-default class of the parent policy map named subscriber_line. The voip and video classes do not have ATM overhead accounting explicitly enabled. These priority classes have ATM overhead accounting implicitly enabled because the parent policy has ATM overhead accounting enabled. Notice that the features in the parent and child policies use the same encapsulation type.

```
policy-map subscriber_classes
```

```
 class voip
  priority level 1
  police 8000
 class video
  priority level 2
  police 20
 class gaming
  bandwidth remaining percent 80 account aal5 snap-rbe-dot1q
 class class-default
  bandwidth remaining percent 20 account aal5 snap-rbe-dot1q
policy-map subscriber_line
 class class-default
  bandwidth remaining ratio 10 account aal5 snap-rbe-dot1q
  shape average 512 account aal5 snap-rbe-dot1q
  service policy subscriber_classes
```

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map, and enables ATM overhead accounting.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps. If configured, the command output includes information about ATM overhead accounting.
show running-config	Displays the current configuration of the router. If configured, the command output includes information about ATM overhead accounting.

shape max-buffers

To specify the number of buffers allowed on shaping queues, use the **shape max-buffers** command in class-map configuration mode. To set the number of buffers to its default value, use the **no** form of this command.

shape max-buffers *number-of-buffers*

no shape max-buffers

Syntax Description

number-of-buffers	Specifies the number of buffers. The minimum number of buffers is 1; the maximum number of buffers is 4096.

Command Default

1000 buffers are preset.

Command Modes

Class-map configuration (config-cmap)

Command History

Release	Modification
12.1(2)T	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)T	This command was integrated into Cisco IOS Release 12.4(20)T, but without support for hierarchical queueing framework (HQF). See the "Usage Guidelines" for additional information.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You can specify the maximum number of buffers allowed on shaping queues for each class configured to use Generic Traffic Shaping (GTS).

You configure this command under a class in a policy map. However, the **shape max-buffers** command is not supported for HQF in Cisco IOS Release 12.4(20)T. Use the **queue-limit** command, which provides similar functionality.

Examples

The following example configures shaping and sets the maximum buffer limit to 100:

```
shape average 350000
shape max-buffers 100
```

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
queue-limit	Specifies or modifies the maximum number of packets a queue can hold for a class policy configured in a policy map.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
shape	Specifies average or peak rate traffic shaping.

shdsl annex

To define the single-pair high-bit-rate digital subscriber line (SHDSL) G.991.2 standard, use the **shdsl annex** command in config controller DSL group mode.

shdsl ***annex {standard}***

Syntax Description

standard	Defines the standard for the selected type of DSL group. **IMA Group** • A • A-B • B **M-PAIR Group** • A • A-B • B • F {**coding** {**16** | **32**}} • F-G {**coding** {**16** | **32** | **16-TCPAM** | **32-TCPAM**} • G {**coding** {**16** | **32** | **16-TCPAM** | **32-TCPAM**} **1-PAIR and 2-PAIR Group** • A • A-B • B • F {**coding** *16* | *32*} • F-G {**coding** {**16** | **32** | **16-TCPAM** | **32-TCPAM**} • G {**coding** {**16** | **32** | **16-TCPAM** | **32-TCPAM**}

Command Default

SHDSL annex B

Command Modes

Config controller DSL group

Command History

Release	Modification
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router and on the Cisco 2800 and 3800 series access routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **dsl-group** command to create a DSL group, and then use the **shdsl annex** command to define the G.991.2 standard for the DSL group.

If you are using IMA to combine two DSL lines, you can only configure the DSL group to use Annex A or Annex B. If you are using an m-pair group, you can only use Annex A,B,F, or G.

Examples

The following example uses the **shdsl annex** command to define the annex standard for a 2-Pair DSL group on a Cisco HWIC-4SHDSL:

```
Router(config-controller-dsl-group)# shdsl annex ?

  A    Annex A of G.991.2 standard
  A-B  Annex A/B of G.991.2 standard
  B    Annex B of G.991.2 standard
  F    Annex F of G.991.2 standard
  F-G  Annex F/G of G.991.2 standard
  G    Annex G of G.991.2 standard

Router(config-controller-dsl-group)# shdsl annex g ?

  coding  16-TCPAM or 32-TCPAM line coding

Router(config-controller-dsl-group)# shdsl annex g coding ?

  16-TCPAM  16-TCPAM line coding
  32-TCPAM  32-TCPAM line coding

Router(config-controller-dsl-group)# shdsl annex g coding 16 ?

  <cr>
```

Related Commands

Command	Description
dsl-group	Creates a DSL group and enters config controller DSL group mode.
shdsl rate	Defines the SHDSL rate.

shdsl rate

To define the single-pair high-bit-rate digital subscriber line (SHDSL) rate, use the **shdsl rate** command in config-controller-dsl-group mode.

shdsl ***rate*** *{number* | ***auto}***

Syntax Description

number	Defines the SHDSL rate for the digital subscriber line (DSL) group. **DSL Group with 1 Pair** Annex A & B—192-2304 kbps Annex F & G (32 TC-PAM)—768-5696 kbps Annex F & G (16 TC-PAM)—2304-3840 kbps **DSL Group with 2 Pairs** Annex A & B—384-4608 kbps Annex F & G (32 TC-PAM)—1536-11392 kbps Annex F & G (16 TC-PAM)— 4608-7680 kbps **DSL Group with 3 Pairs** Annex A & B—576-6912 kbps Annex F & G (32 TC-PAM)—2304-12288 kbps Annex F & G (16 TC-PAM)— 6912-11520 kbps **DSL Group with 4 Pairs** Annex A & B—768-9216 kbps Annex F & G (32 TC-PAM)—3072-16384 kbps Annex F & G (16 TC-PAM)— 9216-15360 kbps
auto	Sets this SHDSL rate to automatic mode.

Command Default

The command default is the maximum annex rate for the selected DSL group.

Command Modes

Config controller DSL group

Command History

Release	Modification
12.4(15)T	This command was introduced for the Cisco HWIC-4SHDSL and HWIC-2SHDSL running on the Cisco 1841 router and on the Cisco 2800 and 3800 series access routers.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **dsl-group** command to create a DSL group, and then use the **shdsl annex** command to define the G.991.2 standard for the newly created DSL group. Define the SHDSL line rate with the **shdsl rate** command.

Examples

The following example defines the SHDSL line rate for DSL group 1, pairs 0-1 (2 pairs) on a Cisco HWIC-4SHDSL:

```
Router(config-controller)# dsl-group 1 pairs 0-1 ima

Router(config-controller-dsl-group)#
Sep 22 14:53:46.481: %HWIC_SHDSL-5-DSLGROUP_UPDOWN: SHDSL 0/2/0 dsl-group(1) state changed
to down.
Sep 22 14:53:48.481: %LINK-3-UPDOWN: Interface ATM0/2/IMA1, changed state to down
Sep 22 14:53:49.481: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/2/IMA1, changed
state to down

Router(config-controller-dsl-group)# shdsl annex ?

  A    Annex A of G.991.2 standard
  A-B  Annex A/B of G.991.2 standard
  B    Annex B of G.991.2 standard

Router(config-controller-dsl-group)# shdsl annex b ?

  <cr>
Router(config-controller-dsl-group)# shdsl rate auto

  <384-4608>  DSL Rate in kbps(line will train at the rate + 16kbps overhead)
  auto        auto rate mode
```

Related Commands

Command	Description
dsl-group	Creates a DSL group and enters config controller DSL group mode.
shdsl annex	Defines the G.991.2 standard for a DSL group.

show

To verify the Multiple Spanning Tree (MST) configuration, use the **show** command in MST configuration mode.

show [**current** | **pending**]

Syntax Description

current	(Optional) Displays the current configuration that is used to run MST.
pending	(Optional) Displays the edited configuration that will replace the current configuration.

Command Default

None

Command Modes

MST configuration (config-mst)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The display output from the **show pending** command is the edited configuration that will replace the current configuration if you enter the **exit** command to exit MST configuration mode.

Entering the **show** command with no arguments displays the pending configurations.

Examples

This example shows how to display the edited configuration:

```
Router# configure terminal
Router(config)# spanning-tree mst configuration
Router(config-mst)# show pending

Pending MST configuration
Name      [zorglub]
Version   31415
Instance  Vlans Mapped
--------  ---------------------------------------------------------------------
0         4001-4096
2         1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110
          1120
3         1-1009, 1011-1019, 1021-1029, 1031-1039, 1041-1049, 1051-1059
          1061-1069, 1071-1079, 1081-1089, 1091-1099, 1101-1109, 1111-1119
          1121-4000
-------------------------------------------------------------------------------
Router(config-mst)#
```

This example shows how to display the current configuration:

```
Router(config-mst)# show current

Current MST configuration
Name []
Revision 0
Instance Vlans mapped
-------- ---------------------------------------------------------------------
0 1-4094
---------------------------------------------------------------------------------
```

Related Commands

Command	Description
instance	Maps a VLAN or a set of VLANs to an MST instance.
name (MST configuration submode)	Sets the name of an MST region.
revision	Sets the revision number for the MST configuration.
show spanning-tree mst	Displays the information about the MST protocol.
spanning-tree mst configuration	Enters MST-configuration submode.

show adjacency

To display information about the Cisco Express Forwarding adjacency table or the hardware Layer 3-switching adjacency table, use the **show adjacency** command in user EXEC or privileged EXEC mode.

show adjacency [*ip-address*] [*interface-type interface-number* | **null** *number* | **port-channel** *number* | **sysclock** *number* | **vlan** *number* | *ipv6-address* | **fcpa** *number* | **serial** *number*] [**connectionid** *number*] [**link** {**ipv4** | **ipv6** | **mpls**}] [**detail** | **encapsulation**]

show adjacency summary [*interface-type interface-number*]

Syntax Description

ip-address	(Optional) An IP address.
interface-type interface-number	(Optional) Interface type and number. Valid values for the *interface-type* argument are **atm**, **async**, **auto-template**, **ctunnel, dialer**, **fastethernet**, **gigabitethernet**, **group-async**, **loopback**, **mfr**, **multilink**, **tunnel**, **vif**, **virtual-template**, and **vlan**.
null *number*	(Optional) Specifies the null interface. The valid value is **0**.
vlan *number*	(Optional) Specifies the VLAN; valid values are 1 to 4094.
serial *number*	(Optional) Specifies the serial interface number; valid values are 1 to 6.
connectionid *number*	(Optional) Specifies the client connection identification number.
link {**ipv4** | **ipv6** | **mpls**}	(Optional) Specifies the link type (IPv4, IPv6, or Multiprotocol Label Switching (MPLS] traffic) of the adjacency.
detail	(Optional) Displays the protocol detail and timer information.
summary	(Optional) Displays a summary of Cisco Express Forwarding adjacency information.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
11.2GS	This command was introduced.
11.1CC	Multiple platform support was added.
12.0(7)XE	Support was added for the Cisco 7600 series routers.
12.1(1)E	Support was added for the Cisco 7600 series routers.
12.1(3a)E3	The number of valid values for **port-channel** *number* changed.
12.1(5c)EX	This command was modified to include Layer 3 information.
12.1(11b)E	The **atm**, **ge-wan**, and **pos** keywords were added.
12.2(8)T	The **detail** keyword output was modified to show the epoch value for each entry of the adjacency table. The **summary** keyword output was modified to show the table epoch for the adjacency table.
12.2(14)SX	Support for this command was added for the Supervisor Engine 720.

Release	Modification
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Cisco IOS Release 12.2(17d)SXB.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S. The **link ipv4**, **link ipv6**, and **link mpls** keywords and the *prefix* argument were added.
12.2(28)SB	Support for IPv6 was added for the Cisco 10000 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.4(20)T	This command was integrated into Cisco IOS Release 12.4(20)T.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **show adjacency** command is used to verify that an adjacency exists for a connected device, that the adjacency is valid, and that the MAC header rewrite string is correct.

For line cards, you must specify the line card if_number (interface number). Use the **show cef interface** command to obtain line card if_numbers.

You can use any combination of the *ip-address, interface-type, and other* keywords and arguments (in any order) as a filter to display a specific subset of adjacencies.

The following information may be displayed by the **show adjacency** commands:

- Protocol
- Interface
- Type of routing protocol that is configured on the interface
- Type of routed protocol traffic using this adjacency
- Next hop address
- Method of adjacency that was learned
- Adjacency source (for example, Address Resolution Protocol (ARP) or ATM Map)
- Encapsulation prepended to packet switched through this adjacency
- Chain of output chain elements applied to packets after an adjacency
- Packet and byte counts
- High availability (HA) epoch and summary event epoch
- MAC address of the adjacent router
- Time left before the adjacency rolls out of the adjacency table. After the adjacency rolls out, a packet must use the same next hop to the destination.

Examples

The following example shows how to display a summary of adjacency information:

```
Router# show adjacency summary

Adjacency table has 7 adjacencies:
  each adjacency consumes 368 bytes (4 bytes platform extension)
  6 complete adjacencies
```

```
  1 incomplete adjacency
  4 adjacencies of linktype IP
    4 complete adjacencies of linktype IP
    0 incomplete adjacencies of linktype IP
    0 adjacencies with fixups of linktype IP
    2 adjacencies with IP redirect of linktype IP
  3 adjacencies of linktype IPV6
    2 complete adjacencies of linktype IPV6
    1 incomplete adjacency of linktype IPV6

Adjacency database high availability:
  Database epoch: 8 (7 entries at this epoch)

Adjacency manager summary event processing:
 Summary events epoch is 52
 Summary events queue contains 0 events (high water mark 113 events)
 Summary events queue can contain 49151 events
 Adj last sourced field refreshed every 16384 summary events
RP adjacency component enabled
```

Related Commands

Command	Description
clear adjacency	Clears the Cisco Express Forwarding adjacency table.
clear arp-cache	Deletes all dynamic entries from the ARP cache.
show adjacency	Enables the display of information about the adjacency database.
show cef interface	Displays detailed Cisco Express Forwarding information for all interfaces.

show atm cell-packing

To display cell packing information for the Layer 2 attachment circuits (ACs) configured on your system, use the **show atm cell-packing** command in privileged EXEC mode.

show atm cell-packing

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows output from the **show atm cell-packing** command:

```
Router# show atm cell-packing
                                      avg #                avg #

     Circuit                    local  cells/pkt  negotiated  cells/pkt    MCPT
     Type                       MNCP    rcvd       MNCP         sent       (us)
ATM0/2/0/1.200    vc 1/200       1       0          1           0          50
ATM0/2/0/1.300    vc 1/300       1       0          1           0          50
```

Related Commands

Command	Description
cell-packing	Packs multiple ATM cells into each MPLS or L2TPv3 packet.
atm cell-packing	Packs multiple ATM cells into each MPLS or L2TPv3 packet.

show cem circuit

To display a summary of CEM circuits, use the **show cem circuit** command in privileged EXEC mode.

show cem circuit [*cem-id*]

Syntax Description

cem-id	(Optional) Identifies the circuit configured with the **cem-group** command.

Command Modes

Privileged EXEC

Command HistoryGl

Release	Modification
12.4(12)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following examples show the output generated by this command;

```
Router# show cem circuit
CEM Int.       ID   Ctrlr     Admin     Circuit         AC
---------------------------------------------------------------
CEM0/0         0    UP        UP        Enabled         UP
CEM0/1         1    UP        UP        Enabled         UP
CEM0/2         2    UP        UP        Enabled         UP
CEM0/3         3    UP        UP        Enabled         UP
CEM0/4         4    UP        UP        Enabled         UP
CEM0/5         5    UP        UP        Enabled         UP

Router# show cem circuit 5

CEM0/5, ID: 5, Line: UP, Admin: UP, Ckt: Enabled
Controller state: up
Idle Pattern: 0xFF, Idle cas: 0x8
Dejitter: 4, Sample Rate: 1, Payload Size: 192
Framing: Framed, (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    527521938           Dropped:             0
Egress Pkts:     527521938           Dropped:             0

CEM Counter Details
Input Errors:    0                   Output Errors:       0
Pkts Missing:    0                   Pkts Reordered:      0
Misorder Drops:  0                   JitterBuf Underrun:  0
Error Sec:       0                   Severly Errored Sec: 0
Unavailable Sec: 0                   Failure Counts:      0
Pkts Malformed:  0
```

Related Commands

Command	Description
show cem circuit detail	Displays detailed information about all CEM circuits.
show cem platform	Displays platform-specific error counters for all CEM circuits.
show cem platform errors	Displays platform-specific error counters for all CEM circuits.

show cem platform

To display platform-specific error counters for all CEM circuits, use the **show cem platform** command in privileged EXEC mode.

show cem platform [*interface*]

Syntax Description

interface	(Optional) Identifies the CEM interface (for example, CEM0/1).

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(12)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following examples show the output generated by this command:

```
Router# show cem platform
CEM0/0 errors:
  net2cem_drops =============== 50/527658758
    net2cem_drops_underflow === 26
    net2cem_drops_overflow ==== 24
  Last cleared 6d02h
CEM0/1 errors:
  net2cem_drops =============== 50/527658759
    net2cem_drops_underflow === 25
    net2cem_drops_overflow ==== 25
  Last cleared 6d02h
CEM0/2 errors:
  net2cem_drops =============== 2/526990836
    net2cem_drops_overflow ==== 2
  Last cleared never
CEM0/3 errors:
  net2cem_drops =============== 1/526982274
    net2cem_drops_overflow ==== 1
  Last cleared never
CEM0/4 errors:
  net2cem_drops =============== 51/527658758
    net2cem_drops_underflow === 26
    net2cem_drops_overflow ==== 25
  Last cleared 6d02h
CEM0/5 errors:
  net2cem_drops =============== 48/527660498
    net2cem_drops_underflow === 24
    net2cem_drops_overflow ==== 24
  Last cleared 6d02h

Router# show cem platform cem0/1
CEM0/1 errors:
  net2cem_drops =============== 50/527678398
    net2cem_drops_underflow === 25
```

```
  net2cem_drops_overflow ==== 25
Last cleared 6d02h
```

Related Commands

Command	Description
show cem circuit	Displays a summary of CEM circuits.
show cem circuit detail	Displays detailed information about all CEM circuits.
show cem platform errors	Displays platform-specific error counters for all CEM circuits.

show connection

To display the status of interworking connections, use the **show connection** command in privileged EXEC mode.

show connection [**all** | *element* | **id** *ID* | **name** *name* | **port** *port*]

Syntax Description

all	(Optional) Displays information about all interworking connections.
element	(Optional) Displays information about the specified connection element.
id *ID*	(Optional) Displays information about the specified connection identifier.
name *name*	(Optional) Displays information about the specified connection name.
port *port*	(Optional) Displays information about all connections on an interface. (In Cisco IOS Release 12.0S, only ATM, serial, and Fast Ethernet connections are shown.)

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(2)T	This command was introduced as **show connect** (FR-ATM).
12.0(27)S	This command was integrated into Cisco IOS Release 12.0(27)S and updated to show all ATM, serial, and Fast Ethernet interworking connections.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.4(2)T	The command output was changed to add Segment 1 and Segment 2 fields for Segment state and channel ID.
12.0(30)S	This command was integrated into Cisco IOS Release 12.0(30)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.4(8)	This command was integrated into Cisco IOS Release 12.4(8).
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows the local interworking connections on a router:

```
Router# show connection
ID   Name               Segment 1            Segment 2           State
========================================================================
1    conn1          ATM 1/0/0 AAL5 0/100   ATM 2/0/0 AAL5 0/100   UP
2    conn2          ATM 2/0/0 AAL5 0/300   Serial0/1 16           UP
```

```
3     conn3          ATM 2/0/0 AAL5 0/400   FA 0/0.1 10            UP
4     conn4          ATM 1/0/0 CELL 0/500   ATM 2/0/0 CELL 0/500   UP
5     conn5          ATM 1/0/0 CELL 100     ATM 2/0/0 CELL 100     UP
```

Table 1-13 describes the significant fields shown in the display.

Table 1-13 show connection Field Descriptions

Field	Description
ID	Arbitrary connection identifier assigned by the operating system.
Name	Name of the connection.
Segment 1 Segment 2	Information about the interworking segments, including: • Interface name and number. • Segment state, interface name and number, and channel ID. Segment state displays nothing if the segment state is UP, "-" if the segment state is DOWN, and "***Card Removed***" if the segment state is DETACHED. • Type of encapsulation (if any) assigned to the interface. • Permanent virtual circuit (PVC) assigned to the ATM interface, data-link connection identifier (DLCI) assigned to the serial interface, or VLAN ID assigned to the Ethernet interface.
State or Status	Status of the connection, which is one of the following: INVALID, UP, ADMIN UP, ADMIN DOWN, OPER DOWN, COMING UP, NOT VERIFIED, ERR.

Related Commands

Command	Description
show atm pvc	Displays the status of ATM PVCs and SVCs.
show frame-relay pvc	Displays the status of Frame Relay interfaces.

show controller

Use the **show controller** command to display the status of an interface.

show controller {ATM | Async | BITS | CEM | E1 | GigabitEthernet | J1 | SHDSL | T1 | RTM} *slot* **/** *port*

Syntax Description

ATM	Displays the status of the ATM controller.
Async	Displays the status of the async controller.
BITS	Displays the status of the BITS controller.
CEM	Displays the status of the CEM controller.
E1	Displays the status oft the E1 controller.
GigabitEthernet	Displays the status of the Gigabit Ethernet controller.
J1	Displays the status of the J1 controller.
SHDSL	Displays the status of the SHDSL controller.
T1	Displays the status of the T1 controller.
rtm	Displays the status of the RTM controller.
slot	The slot number of the interface.
port	The port number of the interface.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(19)MR2	This command was incorporated.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

```
Router# show controller e1 0/2
E1 0/2 is up.
  Applique type is Channelized E1 - balanced
  No alarms detected.
  alarm-trigger is not set
  Version info Firmware: 20050421, FPGA: 13, spm_count = 0
  Daughter card FPGA version: 0x16, source: Bundled
  Framing is NO-CRC4, Line Code is HDB3, Clock Source is Line.
  CRC Threshold is 320. Reported from firmware  is 320.
  VWIC relays are closed
  Link noise monitor disabled
  Data in current interval (330 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     243 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
```

Note The last line of the example shows 243 Slip Secs, indicating a possible clocking issue.

Related Commands

Command	Description
show atm pvc	Displays the status of ATM PVCs and SVCs.

show cns config connections

To display the status of the Cisco Networking Services (CNS) event agent connection, use the **show cns config connections** command in privileged EXEC mode.

show cns config connections

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(8)T	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show cns config connections** command to determine whether the CNS event agent is connecting to the gateway, connected, or active, and to display the gateway used by the event agent and its IP address and port number.

Examples

The following is sample output from the **show cns config connections** command:

```
Router# show cns config connections

The partial configuration agent is enabled.

Configuration server:  10.1.1.1
Port number:           80
Encryption:            disabled
Config id:             test1
Connection Status:     Connection not active.
```

Related Commands

Command	Description
show cns config outstanding	Displays information about incremental CNS configurations that have started but not yet completed.
show cns config stats	Displays statistics about the CNS configuration agent.

show cns config outstanding

To display information about incremental (partial) Cisco Networking Services (CNS) configurations that have started but not yet completed, use the **show cns config outstanding** command in privileged EXEC mode.

show cns config outstanding

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.2(8)T	This command was implemented on Cisco 2600 series and Cisco 3600 series routers.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show cns config outstanding** command to display information about outstanding incremental (partial) configurations that have started but not yet completed, including the following:

- Queue ID (location of configuration in the config queue)
- Identifier (group ID)
- Config ID (identity of configuration within the group)

Examples

The following is sample output from the **show cns config outstanding** command:

```
Router# show cns config outstanding

The outstanding configuration information:
queue id   identifier       config-id
1          identifierREAD   config_idREAD
```

Related Commands

Command	Description
cns config cancel	Cancels an incremental two-phase synchronization configuration.
config-cli	Displays the status of the CNS event agent connection.
show cns config stats	Displays statistics about the CNS configuration agent.

show cns config stats

To display statistics about the Cisco Networking Services (CNS) configuration agent, use the **show cns config stats** command in privileged EXEC mode.

show cns config stats

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.2(8)T	This command was implemented on Cisco 2600 series and Cisco 3600 series routers.
12.3(1)	Additional output fields were added.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command displays the following statistics on the CNS configuration agent:

- The number of configurations requests received
- The number of configurations completed
- The number of configurations failed
- The number of configurations pending
- The number of configurations cancelled
- The time stamp of the last configuration received
- The time stamp of the initial configuration received

Examples

The following is sample output from the **show cns config stats** command:

```
Router# show cns config stats

6 configuration requests received.
4 configurations completed.
1 configurations failed.
1 configurations pending.
```

```
0 configurations cancelled.
The time of last received configuration is *May 5 2003 10:42:15 UTC.
Initial Config received *May 5 2003 10:45:15 UTC.
```

Related Commands

Command	Description
clear cns config stats	Clears all the statistics about the CNS configuration agent.
show cns config outstanding	Displays information about incremental CNS configurations that have started but not yet completed.

show cns event connections

To display the status of the Cisco Networking Services (CNS) event agent connection, use the **show cns event connections** command in privileged EXEC mode.

show cns event connections

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(8)T	This command was introduced.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show cns event connections** command to display the status of the event agent connection—such as whether it is connecting to the gateway, connected, or active—and to display the gateway used by the event agent and its IP address and port number.

Examples

The following example displays the IP address and port number of the primary and backup gateways:

```
Router# show cns event connections

The currently configured primary event gateway:
        hostname is 10.1.1.1.
        port number is 11011.
Event-Id is Internal test1
Keepalive setting:
        none.
Connection status:
        Connection Established.
The currently configured backup event gateway:
        none.
The currently connected event gateway:
        hostname is 10.1.1.1.
        port number is 11011.
```

Related Commands

Command	Description
show cns event stats	Displays statistics about the CNS event agent connection.
show cns event subject	Displays a list of subjects about the CNS event agent connection.

show cns event stats

To display statistics about the Cisco Networking Services (CNS) event agent connection, use the **show cns event stats** command in privileged EXEC mode.

show cns event stats

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(18)ST	This command was integrated into Cisco IOS Release 12.0(18)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.2(8)T	This command was implemented on the Cisco 2600 series and the Cisco 3600 series routers.
12.3(1)	Output was changed to display statistics generated since last cleared.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to display the following statistics for the CNS event agent:

- Number of events received
- Number of events sent
- Number of events not processed successfully
- Number of events in the queue
- Time stamp showing when statistics were last cleared (time stamp is router time)
- Number of events received since the statistics were cleared
- Time stamp of latest event received (time stamp is router time)
- Time stamp of latest event sent
- Number of applications using the Event Agent
- Number of subjects subscribed

Examples

The following example displays statistics for the CNS event agent:

```
Router# show cns event stats

0 events received.
1 events sent.
0 events not processed.
0 events in the queue.
0 events sent to other IOS applications.
Event agent stats last cleared at Apr 4 2003 00:55:25 UTC
No events received since stats cleared
The time stamp of the last received event is *Mar 30 2003 11:04:08 UTC
The time stamp of the last sent event is *Apr 11 2003 22:21:23 UTC
3 applications are using the event agent.
0 subjects subscribed.
1 subjects produced.
0 subjects replied.
```

Related Commands

Command	Description
clear cns event stats	Clears all the statistics about the CNS event agent.
cns event	Enables and configures CNS event agent services.
show cns event connections	Displays the status of the CNS event agent connection.
show cns event subject	Displays a list of subjects about the CNS event agent connection.

show cns event subject

To display a list of subjects about the Cisco Networking Services (CNS) event agent connection, use the **show cns event subject** command in privileged EXEC mode.

show cns event subject [*name*]

Syntax Description

name	(Optional) Displays a list of applications that are subscribing to this specific subject name.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(2)T	This command was introduced.
12.0(18)ST	This command was integrated into Cisco IOS Release 12.0(18)ST.
12.0(22)S	This command was integrated into Cisco IOS Release 12.0(22)S.
12.2(8)T	This command was implemented on the Cisco 2600 series and the Cisco 3600 series.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show cns event subject** command to display a list of subjects of the event agent that are subscribed to by applications.

Examples

The following example displays the IP address and port number of the primary and backup gateways:

```
Router# show cns event subject

The list of subjects subscribed by applications.
   cisco.cns.mibaccess:request
   cisco.cns.config.load
   cisco.cns.config.reboot
   cisco.cns.exec.cmd
```

Related Commands

Command	Description
show cns event connections	Displays the status of the CNS event agent connection.
show cns event stats	Displays statistics about the CNS event agent connection.

show cns image connections

To display the status of the Cisco Networking Services (CNS) image management server HTTP connections, use the **show cns image connections** command in privileged EXEC mode.

show cns image connections

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show cns image connections** command when troubleshooting HTTP connection problems with the CNS image server. The output displays the following information:

- Number of connection attempts
- Number of connections that were never connected and those that were abruptly disconnected
- Date and time of last successful connection

Examples

The following is sample output from the **show cns image connections** command:

```
Router# show cns image connections

CNS Image Agent:  HTTP connections
Connection attempts 1
never connected:0   Abrupt disconnect:0
Last successful connection at 11:45:02.000 UTC Mon May 6 2003
```

Related Commands

Command	Description
show cns image inventory	Displays inventory information about the CNS image agent.
show cns image status	Displays status information about the CNS image agent.

show cns image inventory

To provide a dump of Cisco Networking Services (CNS) image inventory information in extensible markup language (XML) format, use the **show cns image inventory** command in privileged EXEC mode.

show cns image inventory

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

To view the XML output in a better format, paste the content into a text file and use an XML viewing tool.

Examples

The following is sample output from the **show cns image inventory** command:

```
Router# show cns image inventory

Inventory Report
<imageInventoryReport><deviceName><imageID>Router</imageID><hostName>Router</ho
IOS (tm) C2600 Software (C2600-I-M), Experimental Version 12.3(20030414:081500)]
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Mon 14-Apr-03 02:03 by engineer</versionString><imageFile>tftp://10.25>
```

Related Commands

Command	Description
show cns image connections	Displays connection information for the CNS image agent.
show cns image status	Displays status information about the CNS image agent.

show cns image status

To display status information about the Cisco Networking Services (CNS) image agent, use the **show cns image status** command in privileged EXEC mode.

show cns image status

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SB	This command was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to display the following status information about the CNS image agent:

- Start date and time of last upgrade
- End date and time of last upgrade
- End date and time of last successful upgrade
- End date and time of last failed upgrade
- Number of failed upgrades
- Number of successful upgrades with number of received messages and errors
- Transmit status with number of attempts, successes, and failures

Examples

The following is sample output from the **show cns image status** command:

```
Router# show cns image status

Last upgrade started at 11:45:02.000 UTC Mon May 6 2003
Last upgrade ended at 11:56:04.000 UTC Mon May 6 2003 status SUCCESS

Last successful upgrade ended at 00:00:00.000 UTC Mon May 6 2003
Last failed upgrade ended at 00:00:00.000 UTC Wed Apr 16 2003
Number of failed upgrades: 2
Number of successful upgrades: 6
 messages received: 12
```

```
 receive errors: 5
Transmit Status
  TX Attempts:4
    Successes:3         Failures 2
```

Related Commands

Command	Description
show cns image connections	Displays connection information for the CNS image agent.
show cns image inventory	Displays image inventory information in XML format.

show dot1q-tunnel

To display a list of 802.1Q tunnel-enabled ports, use the **show dot1q-tunnel** command in user EXEC mode.

show dot1q-tunnel [**interface** *interface interface-number*]

Syntax Description

interface *interface*	(Optional) Specifies the interface type; possible valid values are **ATM**, **serial**, **fastethernet**, **gigabitethernet**, and **port-channel**.
interface-number	(Optional) Interface number; see the "Usage Guidelines" section for valid values.

Command Modes

User EXEC (>)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **ethernet**, **ge-wan**, **port-channel**, or **tengigabitethernet** keywords.

Usage Guidelines

If you do not enter any keywords, the 802.1Q tunnel ports for all interfaces are displayed.

The *interface-number* argument designates the module and port number for the **ethernet**, **fastethernet**, **gigabitethernet**, and **ge-wan** keywords. Valid values depend on the chassis and module that are used. For example, if you have a 48-port 10/100BASE-T Ethernet module that is installed in a 13-slot chassis, valid values for the slot number are from 1 to 13 and valid values for the port number are from 1 to 48.

The *interface-number* argument designates the port-channel number for the **port-channel** keyword; valid values are from 1 to 282. The values from 257 to 282 are supported on the Content Switching Module (CSM) and the Firewall Services Module (FWSM) only.

Examples

This example indicates that the port is up and has one 802.1Q tunnel that is configured on it:

```
Router# show dot1q-tunnel interface port-channel 10

Interface
---------
Po10
```

Related Commands

Command	Description
switchport mode	Sets the interface type.
vlan dot1q tag native	Enables dot1q tagging for all VLANs in a trunk.

show dsl interface atm

To display information specific to the asymmetric digital subscriber line (ADSL) for a specified ATM interface, use the **show dsl interface atm** command in EXEC mode.

show dsl interface atm *number*

Syntax Description

number	ATM interface number.

Command Modes

EXEC

Command History

Release	Modification
12.1(3)XJ	The command was introduced on Cisco 1700 series routers.
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.1(5)YB	Support for this command was added to Cisco 2600 series and Cisco 3600 series routers.
12.1(5)XR1	Support for this command was added to the Cisco IAD2420 series.
12.2(4)T	This command was integrated into Cisco IOS Release 12.2(4)T.
12.4(20)MR	The command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to display the status or results of a line test and to get information on port status, alarms, configured and actual transmission rates, and transmission errors.

The output from this command appears the same as the output from the **show controller atm** command on Cisco 1400 series routers.

Examples

ADSL: Example

The following example shows sample output from the **show dsl interface atm** command for a CPE device that is configured for ADSL:

```
Router# show dsl interface atm0

Alcatel 20150 chipset information
                ATU-R (DS)                          ATU-C (US)
Modem Status:    Showtime (DMTDSL_SHOWTIME)
DSL Mode:        ITU G.992.1 (G.DMT)
ITU STD NUM:     0x01                                0x1
Vendor ID:       'ALCB'                              'ALCB'
Vendor Specific: 0x0000                              0x0000
Vendor Country:  0x00                                0x0F
Capacity Used:   85%                                 98%
Noise Margin:    13.5 dB                              7.0 dB
Output Power:     9.5 dBm                            12.0 dBm
Attenuation:      1.5 dB                              3.5 dB
```

```
Defect Status:   None                            None
Last Fail Code:  None
Selftest Result: 0x00
Subfunction:     0x15
Interrupts:      5940 (0 spurious)
PHY Access Err:  0
Activations:     1
SW Version:      3.670
FW Version:      0x1A04


                 Interleave              Fast    Interleave              Fast
Speed (kbps):             0              8128             0               864
Reed-Solomon EC:          0                 0             0                 0
CRC Errors:               0                 0             0                 7
Header Errors:            0                 0             0                 2
Bit Errors:               0                 0
BER Valid sec:            0                 0
BER Invalid sec:          0                 0


DMT Bits Per Bin
00: 0 0 0 0 0 0 0 7 6 7 9 A B C C C
10: C C C C C C B B B B A 9 A 9 0 0
20: 0 0 0 0 0 0 2 2 3 4 4 5 6 6 7 7
30: 7 8 8 8 9 9 9 A A A A A A B B B
40: B B B B B B B B B B B A B B B B
50: B B B B B B B B B B B 2 B B B B
60: B B B B B B B B B B B B B B B B
70: B B B B B B B B B B B B B B B B
80: B B B B B B B B B B B B B B B B
90: B B B B B B B B B B B B B B B B
A0: B B B B B B B B B B B B B B B B
B0: B B B B B B B B B B B A B A A A
C0: A A A A A A A A A A A A A A A A
D0: A A A A A A A A A A A 9 9 9 9 9
E0: 9 9 9 9 9 9 9 9 9 9 9 9 8 8 8 8
F0: 8 8 8 8 8 8 7 7 7 7 6 6 5 5 4 4
```

Table 1-14 describes the significant fields shown in the display.

Table 1-14 show dsl interface atm Field Descriptions

Field	Description
Modem Status	Status of the modem. Possible states include the following: DMTDSL_INVALID—Error state. DMTDSL_STOP—Administrative down state. DMTDSL_INIT—Restarting line. DMTDSL_CHK_HW—Confirming that required HW exists. DMTDSL_DLOAD_1—Downloading the init.bin file. DMTDSL_DLOAD_2—Downloading operational firmware. DMTDSL_MODE_CHK—Verifying that download was successful. DMTDSL_DO_OPEN—Issue ADSL_OPEN command. DMTDSL_RE_OPEN—Cycle the link. Retry open. DMTDSL_ACTIVATING—Waiting for activation to succeed. DMTDSL_LOOPBACK—Activation done. DMTDSL_SHOWTIME—Activation succeeded.
DSL Mode	DSL operating mode.
ITU STD NUM	ITU standard number for the operating mode.
Vendor ID	Vendor identification code.
Vendor Specific	Indicates if this router is specified for a vendor.
Vendor Country	Code for the country where the vendor is located.
Capacity Used	Percentage of the capacity that is being used.
Noise Margin	Noise margin, in decibels.
Output Power	Power output, in decibels.
Attenuation	Attenuation of the signal, in decibels.
Defect Status	Status of defects.
Last Fail Code	Last failure code that was logged.
Selftest Result	Results of the self-test.
Subfunction	Code for the subfunction running.
Interrupts	Code for interrupts used.
PHY Access Err	Number of physical access errors.
Activations	Number of activations of the router.
SW Version	Software version number.
FW Version	Firmware version number.
Speed	The train speed for upstream and downstream. It shows both the interleave and the fast mode.
Reed-Solomon EC	Reed-Solomon error-correction statistics.

Table 1-14 show dsl interface atm Field Descriptions (continued)

Field	Description
CRC Errors	Cyclic redundancy check statistics.
Header Errors	ATM header error reports.
Bit Errors	Total number of bit errors.
BER Valid sec	Bit error rate valid seconds.
BER Invalid sec	Bit error rate invalid seconds.

Related Commands

Command	Description
dsl operating-mode	Modifies the operating mode of the digital subscriber line for an ATM interface.

show esmc

To display information about Ethernet Synchronization messaging channel (ESMC) usage, use the **show esmc** command in user EXEC or privileged EXEC mode.

show esmc {detail | interface *interface-name slot* / *port* **[detail]}**

Syntax Description

detail	Displays detailed information about the ESMC configuration for all interfaces.
interface	Specifies an interface.
interface-name	The name of the synchronous Ethernet interface.
slot	The slot of the synchronous Ethernet interface.
port	The port number of the synchronous Ethernet interface.
detail	(Optional) Displays additional detail about the ESMC configuration for an interface.

Command Default

This command is disabled by default; TCP is the default encapsulation.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Examples

The following example show how to configuration enables UDP encapsulation on a CESoPSN pseudowire.

```
Router# show esmc interface gigabitethernet 0/2
Interface: GigabitEthernet0/0/0
Administrative configurations:
  Mode: Synchronous
  ESMC TX: Enable
  ESMC RX : Enable
  QL RX configured : NA
  QL TX configured : NA
Operational status:
  Port status: UP
  QL Receive: QL-SSU-B
  ESMC Information rate : 1 packet/second
  ESMC Expiry: 5 second
```

show ethernet cfm domain

To display information for an Ethernet connectivity fault management (CFM) domain, use the **show ethernet cfm domain** command in privileged EXEC mode.

show ethernet cfm domain [*domain-name* | **brief**]

Syntax Description

domain-name	(Optional) String of a maximum of 154 characters.
brief	(Optional) Specifies a display of brief details about configured maintenance domains.

Command Default

All information about all the configured domains is displayed when the optional keywords are not used.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When a domain name is not specified, information for all domains is shown.

If a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

When the **brief** keyword is used, the command output shows the following summary data:

- Domain name
- Domain index
- Domain level
- Number of maintenance associations in the domain
- Archive hold time for the error and continuity check databases for the domain

Examples

Following is sample output from a **show ethernet cfm domain** command using the **brief** keyword:

```
Router# show ethernet cfm domain brief

Domain Name                                Index Level Services Archive(min)
Domain_L7                                     19     7        1     100
Domain_L5                                     20     5        1     100
Domain_port                                   18     0        1     100
Router1-cfm#
```

Table 1-15 describes the significant fields shown in the display.

Table 1-15 show ethernet cfm domain brief Field Descriptions

Field	Description
Domain Name	Name of the domain.
Index	Running counter
Level	Maintenance domain level.
Services	Number of services running.
Archive(min)	Number of the minutes that data from a missing maintenance endpoint (MEP) is kept in the continuity check database or that entries are held in the error database before they are purged.

Following is sample output from a **show ethernet cfm domain** command when neither of the options is used:

```
Router# show ethernet cfm domain

Domain Name: Domain_L7
Level: 7
Total Services : 1
  Services:
  VLAN Dir CC CC-int Static-rmep Crosscheck MaxMEP MA-Name
  11   Up  Y  10s    Disabled    Disabled   100    cust_700_17

Domain Name: Domain_L5
Level: 5
Total Services : 1
  Services:
  VLAN Dir CC CC-int Static-rmep Crosscheck MaxMEP MA-Name
  9    Up  Y  10s    Disabled    Disabled   100    cust_500_15

Domain Name: Domain_port
Level: 0
Total Services : 1
  Services:
  VLAN Dir CC CC-int Static-rmep Crosscheck MaxMEP MA-Name
none Dwn Y  10s    Disabled    Disabled   100    portmep
```

Table 1-16 describes the significant fields shown in the display.

Table 1-16 show ethernet cfm domain Field Descriptions

Field	Description
Domain Name	Name of the domain.
Level	Maintenance domain level.
Total Services	Number of services running.
Services	The services currently running.
VLAN	Number of the VLAN.
Dir	Either up (toward the switch) or down (toward the LAN or wire).

Table 1-16 show ethernet cfm domain Field Descriptions (continued)

Field	Description
CC	Continuity Check message (CCM) status (enabled or disabled).
CC-int	Time between CCMs.
Static-rmep	Status of the remote MEP.
Crosscheck	Status of the cross-check function.
MaxMEP	Number of maximum MEPs allowed.
MA-Name	Name of the maintenance association.

Related Commands

Command	Description
show ethernet cfm maintenance-points remote	Displays information about remote maintenance points in the continuity check database.
show ethernet cfm maintenance-points remote crosscheck	Displays information about remote maintenance points configured statically in a cross-check list.
show ethernet cfm maintenance-points remote detail	Displays information about a remote maintenance point in the continuity check database.

show ethernet cfm errors

To display connectivity fault management (CFM) continuity check error conditions logged on a device since it was last reset or since the log was last cleared, use the **show ethernet cfm errors** command in privileged EXEC mode.

CFM IEEE 802.1ag Standard (CFM IEEE)

show ethernet cfm errors [**configuration** | **domain-id** {*mac address* | *domain-name* | **dns** *dns-name* | **null**} [**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*}]]

Syntax Description

domain	(Optional) Indicates that a maintenance domain is specified.
domain-name	(Optional) String of a maximum of 154 characters.
configuration	(Optional) Displays the configuration error list information; for example, port, VLAN, and error condition.
domain-id	(Optional) Displays by domain ID.
mac-address	(Optional) MAC address of the maintenance domain.
dns	(Optional) Displays a domain name service (DNS).
dns-name	(Optional) String of a maximum of 43 characters.
null	(Optional) Indicates there is not a domain name.
service	(Optional) Displays a maintenance association within the domain.
ma-name	(Optional) String that identifies the maintenance association.
ma-num	(Optional) Integer that identifies the maintenance association.
vlan-id	(Optional) Displays a VLAN.
vlan-id	(Optional) Integer from 1 to 4094 that identifies the VLAN.
vpn-id	(Optional) Displays a virtual private network (VPN).
vpn-id	(Optional) Integer from 1 to 32767 that identifies the VPN.

Command Default

In CFM IEEE, when no maintenance domain is specified, errors for all domains are displayed.

In CFM D1, when no maintenance domain or maintenance level is specified, errors for all domains and all levels are displayed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.

Release	Modification
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **level** keyword used to configure CFM Draft 1.0.

Usage Guidelines

Errors that are logged and that the **show ethernet cfm errors** command displays depend on the version of CFM that is running. Errors include the following:

- MEP-Down—Maintenance End Point (MEP) timed out or is advertising a 0 lifetime.
- Configuration Error—A continuity check message (CCM) is received that has an maintenance point ID (MPID) matching the local device, but the source MAC address is different.
- Forwarding Loop—A CCM is received, that has the same MPID and same MAC address as the local device.
- Cross-connected—A CCM is received and the service ID does not match the service ID configured on the device for that VLAN.
- Cross-check Missing MEP—The cross-checking delay timer has expired, and the configured remote MEP did not come up.
- Cross-check Unknown MEP—An unexpected remote MEP came up.
- Receive AIS—A MEP detects a mismerge, which is an unexpected MEP condition, or a signal fail condition resulting in peer MEPs receiving an alarm indication signal (AIS) frame.

Error conditions are kept in a log for the duration of the archive hold time configured on the maintenance domain or until the error condition is cleared, whichever occurs first.

Examples

The following example shows CFM IEEE sample output from a **show ethernet cfm errors** command using none of the optional keywords or arguments:

```
Router# show ethernet cfm errors

--------------------------------------------------------------------------------
MPID Domain Id                                Mac Address     Type   Id  Lvl
     MAName                                   Reason                 Age
--------------------------------------------------------------------------------
37   Domain_port                              aabb.cc03.ba00  Port   none 0
     portmep                                  Lifetime Timer Expired 89s
401  Domain_L5                                aabb.cc03.bb99  Vlan   9    5
     cust_500_l5                              Lifetime Timer Expired 88s
301  Domain_L7                                aabb.cc03.bb99  Vlan   11   7
     cust_700_l7                              Lifetime Timer Expired 86s
```

Table 1-17 describes the significant fields shown in the display.

Table 1-17 show ethernet cfm errors Field Descriptions

Field	Description
MPID	Identifier of the MEP on which the error occurred.
Domain Id	Identifier of the domain affected by the error.
Mac Address	MAC address of the remote MEP on which the error occurred.

Table 1-17 show ethernet cfm errors Field Descriptions (continued)

Field	Description
Type	Type of MEP (VLAN or port MEP)
Id	Identifier of the VLAN on which the error occurred.
Lvl	Maintenance level at which the error occurred.
MAName	Name of the maintenance association where the error occurred.
Reason	Explanation of why the error occurred.
Age	Time the error has been in the error database.

The following example shows CFM IEEE sample output from a **show ethernet cfm errors** command using the optional **configuration** keyword:

```
Router# show ethernet cfm errors configuration
------------------------------------------------------------------------------
CFM Interface      Type  Id     Level  Error type
------------------------------------------------------------------------------
Et0/0              VLAN  100    1      CFMLeak
```

Table 1-18 describes the significant fields shown in the display.

Table 1-18 show ethernet cfm errors configuration Field Descriptions

Field	Description
CFM Interface	CFM supported interface on which the error occurred.
Type	Type of MEP (VLAN or port MEP)
Id	Identifier of the VLAN on which the error occurred.
Level	Maintenance level at which the error occurred.
Error type	Type of error.

The following example shows CFM D1 sample output from a **show ethernet cfm errors** command for CFM error conditions at maintenance level 3:

```
Router# show ethernet cfm errors level 3

Level Vlan MPID Remote MAC        Reason               Service ID
5     102   40 aabb.cc00.ca10     Receive AIS       service test
```

Table 1-19 describes the significant fields shown in the display.

Table 1-19 show ethernet cfm errors Field Descriptions

Field	Description
Level	Maintenance level at which the error occurred.
Vlan	VLAN on which the error occurred.
MPID	Identifier of the MEP on which the error occurred.
Remote MAC	The MAC address of the remote MEP on which the error occurred.
Reason	Explanation of why the error occurred.
Service ID	Identifier of the customer affected by the error.

show ethernet cfm maintenance-points local

To display information about maintenance points configured on a device, use the **show ethernet cfm maintenance-points local** command in privileged EXEC mode.

show ethernet cfm maintenance-points local [**detail**] [**mep** | **mip**] [**domain** *domain-name* | **interface** *type number* | **level** *level-id*]

Syntax Description

detail	(Optional) Indicates that detailed output is specified.
mep	(Optional) Indicates that a maintenance endpoint (MEP) is specified.
mip	(Optional) Indicates that a maintenance intermediate point (MIP) is specified.
domain	(Optional) Indicates that a maintenance domain is specified.
domain-name	(Optional) String of a maximum of 154 characters.
interface	(Optional) Indicates that an interface is specified.
type number	(Optional) Type and number of the interface.
level	(Optional) Indicates that a maintenance level is specified.
level-id	(Optional) Integer from 0 to 7 that identifies the maintenance level.

Command Default

When none of the optional keywords and arguments are specified, information about all the maintenance points on the device is shown.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SRD	The **detail** and **evc** keywords and the *evc-name* argument were added.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2. • The **evc** keyword and *evc-name* argument are not supported in this release.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the **evc** parameter.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **show ethernet cfm maintenance-points local** command allows you to filter output. You can display information about maintenance points as follows:

- Independent of domain or interface

- On a particular interface independent of domain
- On a particular interface belonging to a given domain
- Belonging to a given domain independent of interface

The display may also be restricted to either MEPs or MIPs.

If a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

Examples

Following is sample output from a **show ethernet cfm maintenance-points local detail** command when none of the other optional keywords and arguments are specified:

```
Router# show ethernet cfm maintenance-points local detail

Local MEPs:
--------------------------------------------------------------------------------
MPID Domain Name                                Lvl   MacAddress     Type  CC
     Domain Id                                  Dir   Port           Id
     MA Name                                          SrvcInst
     EVC name
--------------------------------------------------------------------------------
301  Domain_L7                                  7     aabb.cc03.bb99 Vlan  Y
     Domain_L7                                  Up    Et0/1          11
     cust_700_l7                                      N/A
     N/A
401  Domain_L5                                  5     aabb.cc03.bb99 Vlan  Y
     Domain_L5                                  Up    Et0/1          9
     cust_500_l5                                      N/A
     N/A

Total Local MEPs: 2

Local MIPs: None
```

Table 1-20 describes the significant fields shown in the display.

Table 1-20 show ethernet cfm maintenance-points local Field Descriptions

Field	Description
MPID	Identifier of the maintenance point.
Domain Name	Name of the domain.
Lvl	Maintenance level where the maintenance point is configured.
MacAddress	MAC address of the maintenance point.
Type	Type of MEP (VLAN or port MEP)
CC	Continuity check operational status.
Domain Id	Identifier of the domain.
Dir	Direction which the maintenance point is facing.
Port	Port MEP.
Id	Identifier of the VLAN.
MA Name	Name of the maintenance association.

Table 1-20 show ethernet cfm maintenance-points local Field Descriptions (continued)

Field	Description
SrvcInst	MAC address of the MEP.
EVC name	Name of the Ethernet virtual circuit (EVC).

show ethernet cfm maintenance-points remote

To display detailed information about remote maintenance endpoints (MEPs) configured statically in the MEP list and their status in the continuity check database (CCDB), use the **show ethernet cfm maintenance-points remote** command in privileged EXEC mode.

CFM IEEE 802.1ag Standard (CFM IEEE)

show ethernet cfm maintenance-points remote [**domain** *domain-name* | [[**crosscheck** | **static**] [**domain** *domain-name* | **mpid** *mpid* [**domain** *domain-name*]] [**port** | **vlan** *vlan-id*]]]

Syntax Description

domain	(Optional) Indicates that a maintenance domain is specified.
domain-name	(Optional) String of a maximum of 154 characters.
crosscheck	(Optional) Shows the Mep-Up status from the D1 crosscheck function.
static	(Optional) Shows the Mep-Up status from the continuity-check static rmep function.
mpid	(Optional) Shows a remote maintenance point.
mpid	(Optional) Integer from 0 to 8191 that identifies the maintenance point.
port	(Optional) Shows the operational state of the port MEP.
vlan	(Optional) Shows a VLAN configuration.
vlan-id	(Optional) Integer from 1 to 4094 that identifies the VLAN.

Command Default

No default settings or behaviors.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SRB	The output of this command was enhanced to include the port state values of REMOTE_EE, LOCAL_EE, and TEST.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	The command output was modified to display when CFM has suspended monitoring of Continuity Check messages from a remote MEP. The command output displays Suspend as the as the MPID operational state (IfSt). This release does not support the **level** keyword used to configure CFM Draft 1.0.

Usage Guidelines

If a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if "id <fmt> <MDID>" is not configured.

When no maintenance domain is specified, all entries are displayed; otherwise only entries belonging to the specified domain or level (CFM D1 only) are shown.

Examples

The following example shows output from a **show ethernet cfm maintenance-points remote** command:

```
Router# show ethernet cfm maintenance-points remote

-------------------------------------------------------------------------------
MPID  Domain Name                                MacAddress          IfSt  PtSt
 Lvl  Domain ID                                  Ingress
 RDI  MA Name                                    Type Id             SrvcInst
      EVC Name                                                       Age
-------------------------------------------------------------------------------
37    Domain_port                                aabb.cc03.ba00      Up    N/A
 0    Domain_port                                Et0/0
 -    portmep                                    Port none           N/A
      N/A                                                            1s
401   Domain_L5                                  aabb.cc03.bb99      Up    Up
 5    Domain_L5                                  Et0/0.9
 -    cust_500_l5                                Vlan 9              N/A
      N/A                                                            2s
301   Domain_L7                                  aabb.cc03.bb99      Up    Up
 7    Domain_L7                                  Et0/0.11
 -    cust_700_l7                                Vlan 11             N/A
      N/A                                                            0s

Total Remote MEPs: 3
```

Table 1-21 describes the significant fields shown in the display.

Table 1-21 show ethernet cfm maintenance-points remote Field Descriptions

Field	Description
MPID	Identifier of the MEP.
Lvl	Maintenance level.
RDI	Remote defect indication (RDI) messages on the maintenance point.
Domain Name	Name of the domain.
Domain ID	MAC address of the MEP.
MA Name	Name of the maintenance association.
EVC Name	Identifier of the Ethernet virtual circuit (EVC).
Mac Address	MAC address of the MEP.
Ingress	Port on which the packet is received.
Type Id	Type of service.
IfSt	Operational state of the interface.
SrvcInst	MAC address of the MEP.

Table 1-21 show ethernet cfm maintenance-points remote Field Descriptions (continued)

Field	Description
Age	Amount of time, in seconds, the entry has been in the database.
PtSt	Operational state of the port MEP. Values are: UP—Operational. DOWN—Not operational. ADMINDOWN—Administratively down. REMOTE_EE—Encountered excessive remote errors. LOCAL_EE—Encountered excessive local errors. TEST—Test state.

Related Commands

Command	Description
show ethernet cfm maintenance-points local	Displays information about maintenance points configured on a device.
show ethernet cfm maintenance-points remote crosscheck	Displays information about remote maintenance points configured statically in a cross-check list.
show ethernet cfm maintenance-points remote detail	Displays information about a remote maintenance point in the continuity check database.

show ethernet cfm maintenance-points remote crosscheck

To display information about remote maintenance points configured statically in a cross-check list, use the **show ethernet cfm maintenance-points remote crosscheck** command in privileged EXEC mode.

show ethernet cfm maintenance-points remote crosscheck [**mpid** *id* | **mac** *mac-address*] [**domain** *domain-name*] [**vlan** *vlan-id*]

Syntax Description

mpid	(Optional) Indicates that a maintenance domain is specified.
id	(Optional) Integer from 0 to 8191 that identifies the maintenance domain.
mac	(Optional) Indicates that a maintenance domain is specified.
mac-address	(Optional) MAC address of the remote maintenance point, in the format abcd.abcd.abcd.
domain	(Optional) Indicates that a maintenance domain is specified.
domain-name	(Optional) String of a maximum of 154 characters.
vlan	(Optional) Indicates a VLAN for configuration.
vlan-id	(Optional) Integer value of 1 to 4094 that identifies the VLAN.

Command Default

When no options are specified, maintenance point IDs (MPIDs), MAC addresses, domains, levels, and VLANs for all maintenance points on the list are displayed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SRD	The **evc** keyword and *evc-name* argument were added on the Cisco 7600 Series Route Switch Processor 720 (RSP 720) and the Cisco 7600 Series Supervisor Engine 720.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the **evc** parameter.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

Following is sample output from a **show ethernet cfm maintenance-points remote crosscheck** command for maintenance points at maintenance level 4:

```
Router# show ethernet cfm maintenance-points remote crosscheck level 4
-------------------------------------------------------------------------------
MPID Level VLAN Mep-Up Remote Mac
-------------------------------------------------------------------------------
200  4     0    No     aabb.cc00.0310
-------------------------------------------------------------------------------
```

```
MPID Level Mep-Up Remote Mac
           EVC
------------------------------------------------------------------------------
200  4     No     aabb.cc00.0310
           evc_100
```

Table 1-22 describes the significant fields shown in the display.

Table 1-22 show ethernet cfm maintenance-points remote crosscheck Field Descriptions

Field	Description
MPID	Identifier of the maintenance point.
Level	Maintenance level where the maintenance point is configured.
VLAN	ID of the VLAN on which the maintenance point is configured.
Mep-Up	Operational status of the MEP.
Remote Mac	MAC address of the remote maintenance point.
EVC	ID of the EVC on which the maintenance point is configured.

Related Commands

Command	Description
show ethernet cfm maintenance-points local	Displays information about maintenance points configured on a device.
show ethernet cfm maintenance-points remote	Displays information about remote maintenance points in the continuity check database.
show ethernet cfm maintenance-points remote detail	Displays information about a remote maintenance point in the continuity check database.

show ethernet cfm maintenance-points remote detail

To display information about a remote maintenance point in the continuity check database, use the **show ethernet cfm maintenance-points remote detail** command in privileged EXEC mode.

CFM IEEE 802.1ag Standard (CFM IEEE)

show ethernet cfm maintenance-points remote detail {**mac** *mac-address* | **mpid** *id*} [**domain** *domain-name* [**port** | **vlan** *vlan-id*]]

Syntax Description

mac	Shows a remote MAC address.
mac-address	MAC address of the remote maintenance point, in the format abcd.abcd.abcd.
mpid	Shows a remote maintenance point.
id	Integer from 0 to 8191 that identifies the maintenance point.
domain	(Optional) Shows a specific maintenance domain.
domain-name	(Optional) String of a maximum of 154 characters.
port	(Optional) Shows the operational state of the port MEP.
vlan	(Optional) Shows a VLAN configuration.
vlan-id	(Optional) Integer from 1 to 4094 that identifies the VLAN.

Command Default

When no options are specified, all remote maintenance endpoints (MEPs) matching the specified MAC address or maintenance point ID (MPID) are displayed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SRD	Output was modified in Cisco IOS Release 12.2(33)SRD to show detailed information about Receive RDI and EVC. The **evc** keyword and *evc-name* argument were also introduced.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. This release does not support the **evc** parameter.
15.0(1)MR	The command output was modified to display when CFM has suspended monitoring of Continuity Check messages from a remote MEP. The command output indicates the suspended status and suspended time remaining in the CC Lifetime value. This release does not support CFM Draft 1.0 syntax, which includes the **level** and **service** keywords.

Usage Guidelines

Use this command to obtain information about a specific maintenance point by specifying its MPID or to obtain information about all maintenance points that have a particular MAC address.

When a maintenance domain is not specified, all matching maintenance points, independent of their levels (CFM D1 only), are displayed; otherwise, only maintenance points at the specified maintenance domain are shown.

In CFM D1 only, when an EVC is specified, only maintenance points that are members of the EVC are displayed.

When a VLAN is specified, only maintenance points on that VLAN are displayed.

Examples

The following is sample output from a **show ethernet cfm maintenance-points remote detail** command using the **mpid** option:

```
Router# show ethernet cfm maintenance-points remote detail mpid 401

Version: IEEE-CFM
MAC Address: aabb.cc03.bb99
Domain Name: Domain_L5
MA Name: cust_500_l5
Level: 5
VLAN: 9
MPID: 401
Sender Chassis ID: Router3-cfm
Incoming Port(s): Ethernet0/0.9
CC Lifetime(sec): 35
Age of Last CC Message(sec): 10
CC Packet Statistics: 91/0 (Received/Error)
MEP interface status: Up
MEP port status: Up
Receive RDI: FALSE
Router#
```

Table 1-23 describes the significant fields shown in the display.

Table 1-23 show ethernet cfm maintenance-points remote detail Field Descriptions

Field	Description
Version	Version of CFM that is running.
MAC Address	MAC address of the remote MEP
Domain Name	Name of the domain.
MA Name	Name of the maintenance association.
Level	Maintenance domain level.
VLAN	Configured VLAN.
MPID	Identifier of the maintenance point.
Sender Chassis ID	Name of the other switch or router when sender-id is configured on that device.
Incoming Port(s)	Identifier of the port that receives the message.
CC Lifetime(sec)	Amount of time, in seconds, that the message should remain in the database before being purged.
Age of Last CC Message(sec)	Amount of time, in seconds, the previous continuity check message (CCM) has been in the database.
CC Packet Statistics	Number of packets received and number of packets with errors.
MEP interface status	Operational state of the MEP interface.
MEP port status	Operational state of the MEP port.
Receive RDI	Receive status of remote defect indication (RDI) messages on the maintenance point.

Related Commands

Command	Description
show ethernet cfm maintenance-points local	Displays information about maintenance points configured on a device.
show ethernet cfm maintenance-points remote	Displays information about remote maintenance points in the continuity check database.
show ethernet cfm maintenance-points remote crosscheck	Displays information about remote maintenance points configured statically in a cross-check list.

show ethernet cfm mpdb

To display the contents of a maintenance intermediate point (MIP) continuity check database (CCDB), use the **show ethernet cfm mpdb** command in privileged EXEC mode.

show ethernet cfm mpdb [**domain-id** {*mac-address domain-number* | *domain-name* | **dns** *dns-name* | **null**}] [**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*}]

Syntax Description

domain-id	(Optional) Displays by domain ID.
mac-address	(Optional) MAC address of the maintenance domain.
domain-number	(Optional) Integer from 0 to 65535.
domain-name	(Optional) String of a maximum of 43 characters.
dns	(Optional) Specifies a domain name service (DNS).
dns-name	(Optional) String of a maximum of 43 characters.
null	(Optional) Indicates there is not a domain name.
service	(Optional) Specifies a maintenance association within the domain.
ma-name	(Optional) String that identifies the maintenance association.
ma-num	(Optional) Integer that identifies the maintenance association.
vlan-id	(Optional) Specifies a VLAN.
vlan-id	(Optional) Integer from 1 to 4094 that identifies the VLAN.
vpn-id	(Optional) Specifies a virtual private network (VPN).
vpn-id	(Optional) Integer from 1 to 32767 that identifies the VPN.

Command Default

When no maintenance domain is specified, all entries are displayed.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was integrated into Cisco IOS Release 12.2(33)SRE.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to display cataloged information received from MEPs.

Examples

The following example shows sample output from a **show ethernet cfm mpdb** command:

```
Router# show ethernet cfm mpdb

* = Can Ping/Traceroute to MEP
--------------------------------------------------------------------------------
```

```
MPID  Domain Name                                    MacAddress          Version
Lvl   Domain ID                                      Ingress
Expd  MA Name                                        Type Id             SrvcInst
      EVC Name                                                          Age
------------------------------------------------------------------------------
220 * Domain_L5                                      aabb.cc03.b999      IEEE-CFM
5     Domain_L5                                      Et0/0.1
EXPD  cust_500_l5                                    Vlan 9              N/A
      N/A                                                               87s
101 * Domain_L7                                      aabb.cc03.b999      IEEE-CFM
7     Domain_L7                                      Et0/0.11
-     cust_700_l7                                    Vlan 11             N/A
      N/A                                                               1s

Total Remote MEPs: 2
```

Table 1-24 describes the significant fields shown in the display.

Table 1-24 show ethernet cfm mpdb Field Descriptions

Field	Description
MPID	Maintenance endpoint ID.
Domain Name	Maintenance domain name.
MacAddress	MAC address of the remote MEP.
Version	Version of the CFM protocol that is running.
Lvl	Maintenance domain level.
Domain ID	Maintenance domain identifier.
Ingress	Interface receiving connectivity fault management traffic.
Expd	Lifetime timer has expired.
MA Name	Name of the maintenance association.
Type Id	Identifies a port MEP, VLAN, or Bridge Domain (BD). “None” indicates an untagged port MEP and a number indicates a VLAN or BD.
SrvcInst	Service instance
EVC Name	Identifier of the Ethernet virtual circuit (EVC).
Age	Age of message in the MIP CCDB.

show ethernet cfm smep

To display connectivity fault management (CFM) system maintenance end point (SMEP) settings on a device, use the **show ethernet cfm smep** command in privileged EXEC mode.

show ethernet cfm smep [**interface gigabitethernet** *number*]

Syntax Description

interface	(Optional) Displays information about an interface.
gigabitethernet	(Optional) Displays information about a Gigabit Ethernet interface.
number	(Optional) • Integer from 1 to 6 that identifies a Gigabit Ethernet interface. • Integer from 1 to 564 that identifies a port channel.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
15.0(1)XA	This command was modified. Support for the **port channel** keyword was introduced in Cisco IOS Release 15.0(1)XA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **port channel** keyword.

Usage Guidelines

This command allows filtering on a per-interface basis.

Alarm Indication Signal (AIS) messages are sent by default at the configured maintenance intermediate point (MIP) level if an AIS level is not configured.

Examples

The following example shows sample output from the **show ethernet cfm smep** command:

```
Router# show ethernet cfm smep

SMEP Settings:
--------------
Interface: GigabitEthernet1/1
LCK-Status: CFM Disabled
LCK Period: 60000 (ms)
Level to transmit LCK: Default
AIS-Status: CFM Disabled
AIS Period: 60000 (ms)
Level to transmit AIS: Default
Defect Condition: No Defect
```

Table 1-25 describes the significant fields shown in the display.

Table 1-25 show ethernet cfm smep Field Descriptions

Field	Description
Interface	Specifies the interface type.
LCK-Status	Locked Signal function (LCK) sending status of the interface.
LCK Period	LCK transmission period on the interface.
Level to transmit LCK	Displays the level at which LCK frames are transmitted.
AIS-Status	AIS sending status of the interface.
AIS Period	AIS transmission period on the interface.
Level to transmit AIS	Displays the level at which AIS frames are transmitted.
Defect Condition	Displays the defect condition detected on the interface.

show ethernet cfm statistics

To display Ethernet connectivity fault management (CFM) information, use the **show ethernet cfm statistics** command in privileged EXEC mode.

show ethernet cfm statistics [**domain** [*domain-name* [**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*}]] | **mpid** *mpid*]

Syntax Description

domain	(Optional) Configures a maintenance domain.
domain-name	(Optional) String of a maximum of 154 characters.
service	(Optional) Configures a maintenance association within the domain.
ma-name	(Optional) String that identifies the maintenance association.
ma-num	(Optional) Integer that identifies the maintenance association.
vlan-id	(Optional) Configures a VLAN.
vlan-id	(Optional) Integer from 1 to 4094 that identifies the VLAN.
vpn-id	(Optional) Configures a virtual private network (VPN).
vpn-id	(Optional) Integer from 1 to 32767 that identifies the VPN.
mpid	(Optional) Configures a maintenance point identifier.
mpid	(Optional) Integer from 1 to 8191 that identifies the maintenance point.

Command Default

All domains are displayed when none of the keywords or arguments are selected.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to display an overview of transmitted and received messages.

If a domain name has more than 43 characters, a warning message is displayed notifying that the maintenance domain ID (MDID) will be truncated to 43 characters in continuity check messages (CCMs) if “id <fmt> <MDID>” is not configured.

Examples

Following is sample output from a **show ethernet cfm statistics** command:

```
Router# show ethernet cfm statistics

BRAIN MAC: aabb.cc03.b999
```

```
DomainName: Domain_L7
MA Name: cust_700_l7
MPID: 101
  Last clearing of counters:  never
  CCMs:
    Transmitted:                242   Rcvd Seq Errors:        0
  LTRs:
    Unexpected Rcvd:              0
  LBRs:
    Transmitted:                  0   Rcvd Seq Errors:        0
    Rcvd in order:                0   Rcvd Bad MSDU:          0

DomainName: Domain_L5
MA Name: cust_500_l5
MPID: 220
  Last clearing of counters:  never
  CCMs:
    Transmitted:                202   Rcvd Seq Errors:        0
  LTRs:
    Unexpected Rcvd:              0
  LBRs:
    Transmitted:                  0   Rcvd Seq Errors:        0
    Rcvd in order:               10   Rcvd Bad MSDU:          0

DomainName: Domain_port
MA Name: portmep
MPID: 112
  Last clearing of counters:  never
  CCMs:
    Transmitted:                278   Rcvd Seq Errors:        0
  LTRs:
    Unexpected Rcvd:              0
  LBRs:
    Transmitted:                  0   Rcvd Seq Errors:        0
    Rcvd in order:                0   Rcvd Bad MSDU:          0
```

Table 1-26 describes the significant fields shown in the display.

Table 1-26 show ethernet cfm statistics Field Descriptions

Field	Description
BRAIN MAC	Bridge brain MAC address.
DomainName	Domain name.
MA Name	Maintenance association name.
MPID	Maintenance point identifier.
CCMs	Continuity check messages transmitted.
LTRs	Linktrace responses.
LBRs	Loopback responses.

show ethernet cfm traceroute-cache

To display the contents of the traceroute cache, use the **show ethernet cfm traceroute-cache** command in privileged EXEC mode.

show ethernet cfm traceroute-cache

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show ethernet cfm traceroute-cache** command to display the contents of the traceroute cache; for example, to see the maintenance intermediate points (MIPs) and maintenance endpoints (MEPs) of a domain as they were discovered. The data is historic. The traceroute cache stores entries from previous traceroute operations.

Examples

The following example shows output from a **show ethernet cfm traceroute-cache** command:

```
Router# show ethernet cfm traceroute-cache

Traceroute to aabb.cc03.b999 on Domain Domain_L5, Level 5, vlan 9 issued at 01:25:22
path found via MPDB


B = Intermediary Bridge
! = Target Destination
* = Per hop Timeout
-------------------------------------------------------------------------------
                              MAC      Ingress      Ingr Action  Relay Action
  Hops   Host             Forwarded   Egress       Egr Action   Previous Hop
-------------------------------------------------------------------------------
! 1                   aabb.cc03.b999                           RlyHit:MEP
                      Not Forwarded                            aabb.cc03.bb99
```

Table 1-27 describes the significant fields shown in the display.

Table 1-27 show ethernet cfm traceroute-cache Field Descriptions

Field	Description
Hops	Number of hops of the traceroute.
Host	Name of the device.
MAC	Bridge Brain MAC address of the device.
Ingress	Receiving port.
Ingr Action	Action on the ingress port: IngOk, IngFilter, IngBlocked.
Relay Action	Type of relay action performed: RlyNone, RlyUnknown, RlyFDB, RlyCCDB, RlyFiltered.
Forwarded	Traceroute forwarded or not forwarded.
Egress	Sending port.
Egr Action	Action on the egress port: EgrNone, EgrTTL, EgrDown, EgrBlocked, EgrOk, EgrGVRP, EgrDomainBoundary, EgrFiltered.
Previous Hop	MAC address of the neighboring device.

Related Commands

Command	Description
clear ethernet cfm traceroute-cache	Removes the contents of the traceroute cache.
ethernet cfm traceroute-cache	Enables caching of Ethernet CFM data learned through traceroute messages.
traceroute ethernet	Sends Ethernet CFM traceroute messages to a destination MAC address.

show ethernet lmi

To display Ethernet local management interface (LMI) Ethernet virtual connections (EVCs) configured on a device, use the **show ethernet lmi** command in privileged EXEC mode.

show ethernet lmi {{**evc** [**detail** *evc-id* [**interface** *type number*] | **map interface** *type number*]} | {**parameters** | **statistics**} **interface** *type number* | **uni map** [**interface** *type number*]}

Syntax Description

evc	Displays information about an EVC.
detail	(Optional) Displays detailed information about a specified EVC.
evc-id	(Optional) String of a maximum of 100 characters that identifies an EVC.
interface	Indicates that an interface is specified. This keyword is optional except with the **parameters** and **statistics** keywords.
type	String that identifies the type of interface. Valid options are the following: • **ethernet**—Ethernet IEEE 802.3 interface • **fastethernet**—Fast Ethernet IEEE 802.3 interface • **gigabitethernet**—Gigabit Ethernet IEEE 802.3z interface
number	Integer that identifies the interface.
map	(Optional) Indicates a VLAN map.
parameters	Displays Ethernet LMI parameters.
statistics	Displays Ethernet LMI statistics.
uni map	Displays information about the user-network interface (UNI).

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.4(9)T	This command was introduced.
12.2(33)SRB	Support for this command on the Cisco 7600 router was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to check the operational statuses of EVCs.

Examples

The following examples show output from a **show ethernet lmi** command for interface Ethernet 0/0 using different keywords and arguments.

The following sample output is generated from the **show ethernet lmi** command using the **evc** keyword:

```
Router# show ethernet lmi evc

St  EVC Id                                                  Port
```

```
---  ------------------------------------------------------------ --------------
 A   EVC_MP2MP_101                                                Gi0/1
 A   EVC_P2P_110                                                  Gi0/1

Key: St=Status, A=Active, P=Partially Active, I=Inactive, ?=Link Down
```

The following sample output is generated from the **show ethernet lmi** command using the **evc** and optional **detail** keywords:

```
Router# show ethernet lmi evc detail EVC_MP2MP_101

EVC Id: EVC_MP2MP_101
interface Ethernet0/0
  Time since Last Full Report: 00:25:25
  Ether LMI Link Status: Up
  UNI Status: Up
  UNI Id: router3-e0/0+router-e0/0
  CE-VLAN/EVC Map Type: Bundling
  VLAN: 101

  EVC Status: Active
  EVC Type: Multipoint-to-Multipoint
  Remote UNI Count: Configured = 2, Active = 2

  UNI Id                                    UNI Status    Port
  ------                                    ----------    ----
  router4-e0/0+router1-e0/0                 Up            Remote
  router5-e0/0+router6-e0/0                 Up            Remote
```

Table 1-28 describes the significant fields shown in output of the **show ethernet lmi** command using the **evc** and **detail** keywords.

Table 1-28 show ethernet lmi evc detail Field Descriptions

Field	Description
EVC Id	Identifier of the EVC.
Time since Last Full Report	Number of hours, minutes, seconds since the CE requested a detailed report.
Ether LMI Link Status	Operational state of the LMI link.
UNI Status	Operational state of the UNI.
UNI Id	Identifier of the UNI between the CE and PE devices.
CE-VLAN/EVC Map Type	EVC map type: bundling, multiplex, or all-to-one
VLAN	Identifier of the VLAN.
EVC Status	Operational state of the EVC.
EVC Type	Type of connection (point-to-point or multipoint-to-multipoint).
Remote UNI Count	Number of remote UNIs that are configured and the number that are operational.
Port	Type of port, either local or remote, on which the EVC is configured. If the port is local, the interface ID is specified.

The following sample output is generated from the **show ethernet lmi** command using the **map interface** keyword:

```
Router# show ethernet lmi evc map interface Ethernet0/0

UNI Id: router3-e0/0+router-e0/0
St  Evc Id                                  CE-VLAN
--- --------------------------------------- ----------------------------------
  A EVC_MP2MP_101                           101
  A EVC_P2P_110                             110

Key: St=Status, A=Active, P=Partially Active, I=Inactive, *=Default EVC,
      ?=Link Down
```

Table 1-29 describes the significant fields shown in output of the **show ethernet lmi** command using the **evc** and **map** keywords.

Table 1-29 show ethernet lmi evc map Field Descriptions

Field	Description
UNI Id	Identifier of the UNI between the CE and PE devices.
St	Operational state of the EVC.
Evc Id	Identifier of the EVC.
CE-VLAN	Identifier of the VLAN used by the CE.

The following sample output is generated from the **show ethernet lmi** command using the **parameters** and **interface** keywords:

```
Router# show ethernet lmi parameters interface Ethernet0/0

E-LMI Parameters for interface Ethernet0/0
 Version : MEF.16-0106
    Mode : CE
    T391 : 10
    T392 : NA
    N391 : 360
    N393 : 4
```

Table 1-30 describes the significant fields shown in output of the **show ethernet lmi** command using the **parameters** keyword.

Table 1-30 show ethernet lmi parameters Field Descriptions

Field	Description
Version	Version number of the specification that E-LMI implementation is based on.
Mode	Customer equipment or the Metro Ethernet network.
T391	Polling timer.
T392	Polling verification timer.
N391	Polling counter.
N393	Event counter.

The following sample output is generated from the **show ethernet lmi** command using the **statistics** and **interface** keywords:

```
Router# show ethernet lmi statistics interface Ethernet0/0
```

```
E-LMI Statistics for interface Ethernet0/0
  Ether LMI Link Status: Up
  UNI Status: Up
  UNI Id: router3-e0/0+router-e0/0

  Reliability Errors:
    Status Timeouts                    0  Invalid Sequence Number           0
    Invalid Status Response            0  Unsolicited Status Received       0

  Protocol Errors:
    Invalid Protocol Version           0  Invalid EVC Reference Id          0
    Invalid Message Type               0  Out of Sequence IE                0
    Duplicated IE                      0  Mandatory IE Missing              0
    Invalid Mandatory IE               0  Invalid non-Mandatory IE          0
    Unrecognized IE                    0  Unexpected IE                     0
    Short Message                      0

  Last Full Status Enq Sent     00:50:35  Last Full Status Rcvd      00:50:35
  Last Status Check Sent        00:00:06  Last Status Check Rcvd     00:00:06
  Last clearing of counters     00:09:57
```

Note The UNI Id field displays only when it is available from the provider edge router.

Table 1-31 describes the significant fields shown in output of the **show ethernet lmi** command using the **statistics** keyword.

Table 1-31 show ethernet lmi statistics Field Descriptions

Field	Description
E-LMI Statistics for interface <interface-id>	
Ether LMI Link Status	Operational state of Ethernet LMI connectivity.
UNI Status	Operational state of the UNI.
UNI Id	Identifier of the UNI.
Reliability Errors	
Status Timeouts	Number of times that a status request has been sent but not received.
Invalid Sequence Number	Number of times the sequence numbers of Ethernet LMI packets do not match the sequence numbers expected.
Invalid Status Response	Number of times a status response received was invalid and discarded.
Unsolicited Status Received	Number of times status was received that had not been requested.
Protocol Errors	
Invalid Protocol Version	Number of times the protocol version in Ethernet LMI packets does not match what is supported.
Invalid EVC Reference Id	Number of times EVC reference IDs are invalid in Ethernet LMI packets.
Invalid Message Type	Number of message types that are not valid for LMI.

Table 1-31 show ethernet lmi statistics Field Descriptions (continued)

Field	Description
Out of Sequence IE	Number of information elements (IEs) that are not in the correct sequence.
Duplicated IE	Number of duplicated IEs.
Mandatory IE Missing	Number of mandatory IEs that are missing.
Invalid Mandatory IE	Number of mandatory IEs that are invalid.
Invalid non-Mandatory IE	Number of non-mandatory IEs that are invalid.
Unrecognized IE	Number of IEs that are not recognized.
Unexpected IE	Number of IEs that are unexpected.
Short Message	Number of times the Ethernet LMI message received is shorter than supported packets.
Last Full Status Enq Sent	Time in hours, minutes, and seconds when the CE sent the last full LMI status request.
Last Full Status Rcvd	Time in hours, minutes, and seconds when the CE received the last full LMI status report.
Last Status Check Sent	Time in hours, minutes, and seconds when the CE sent the last LMI status request.
Last Status Check Rcvd	Time in hours, minutes, and seconds when the CE received the last LMI status report.
Last clearing of counters	Time in hours, minutes, and seconds when the clear **ethernet lmi statistics** command was issued for the interface.

The following sample output is generated from the **show ethernet lmi** command using the **uni map** keyword:

```
Router# show ethernet lmi uni map

UNI Id                           EVC Id                           Port
-------------------------------- -------------------------------- ------------
uni_sandiego                     EVC_MP2MP_101                    Gi0/1
uni_sandiego                     EVC_P2P_110                      Gi0/1
Router#
```

The following sample output is generated from the **show ethernet lmi** command using the **uni map** and optional **interface** keywords:

```
Router# show ethernet lmi uni map interface gigabitethernet 0/1

UNI Id                           EVC Id                           Port
-------------------------------- -------------------------------- ------------
uni_sandiego                     EVC_MP2MP_101                    Gi0/1
uni_sandiego                     EVC_P2P_110                      Gi0/1
Router#
```

Table 1-32 describes the significant fields shown in output of the **show ethernet lmi** command using the **uni map** keyword and **uni map** and **interface** keyword pair.

Table 1-32 show ethernet lmi uni map and uni map interface Field Descriptions

Field	Description
UNI Id	Identifier of the UNI.
EVC Id	Identifier of the EVC.
Port	Interface on the CE device.

show ethernet loopback

Use the **show ethernet loopback** privileged EXEC command to display information about per port Ethernet loopbacks configured on the router or on an interface.

show ethernet loopback [*interface-id*] [| {**begin** | **exclude** | **include**} *expression*]

Syntax Description

interface-id	(Optional) Show loopback information for the specified interface. Only physical interfaces support Ethernet loopback.
| begin	(Optional) Display begins with the line that matches the *expression*.
| exclude	(Optional) Display excludes lines that match the *expression*.
| include	(Optional) Display includes lines that match the specified *expression*.
expression	Expression in the output to use as a reference point.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(44)EY	This command was introduced.
15.1(1)MR	This command was integrated into Cisco IOS Release 15.1(1)MR.

Usage Guidelines

If you do not specify an *interface-id*, all configured loopbacks appear. The router supports a maximum of two Ethernet loopback configurations.

Expressions are case sensitive. For example, if you enter **| exclude output**, the lines that contain *output* are not displayed, but the lines that contain *Output* are displayed.

This command is only supported on onboard Gigabit Ethernet interfaces.

Examples

This is an example of output from the **show ethernet loopback** command:

```
Router# show ethernet loopback
==================================
Loopback Session 0  : Interface Gi0/3
Status              : configured
MAC Mode            : swap
Time out            : 60
```

Related Commands

Command	Description
ethernet loopback (interface configuration)	Configures an Ethernet loopback operation on an interface.
ethernet loopback (privileged EXEC)	Starts or stops the loopback operation.

show ethernet oam discovery

To display discovery information for all Ethernet operations, maintenance, and administration (OAM) interfaces or for a specific interface, use the **show ethernet oam discovery** command in privileged EXEC mode.

show ethernet oam discovery [**interface** *type number*]

Syntax Description

interface	(Optional) Specifies an interface.
type	(Optional) Type of Ethernet interface. Valid values are: FastEthernet, GigabitEthernet.
number	(Optional) Integer from 1 to 9 that is the number of the Ethernet interface.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command displays the following information pertaining to Ethernet OAM discovery:

- Remote device which is directly connected to this device
- Local and remote OAM configuration and capability
- Local and remote OAM mode
- Remote platform identity
- State of the local discovery state machine

If an interface is specified, only data pertaining to the OAM peer on that interface is displayed; otherwise, data for all OAM peers (on all interfaces) is displayed.

Examples

The following example shows output from a **show ethernet oam discovery** command for interface GigabitEthernet 6/11:

```
Router# show ethernet oam discovery interface gigabitethernet6/11

GigabitEthernet6/11
Local client
------------
  Administrative configurations:
    Mode:             active
    Unidirection:     not supported
```

```
    Link monitor:       supported (on)
    Remote loopback:    supported
    MIB retrieval:      not supported
    Mtu size:           1500
Operational status:
    Port status:        operational
    Loopback status:    no loopback
    PDU revision:       1

Remote client
-------------
  MAC address: 0030.96fd.6bfa
  Vendor(oui): 0x00 0x00 0x0C (cisco)

  Administrative configurations:
    Mode:               active
    Unidirection:       not supported
    Link monitor:       supported
    Remote loopback:    supported
    MIB retrieval:      not supported
    Mtu size:           1500
```

Table 1-33 describes the significant fields shown in the display.

Table 1-33 show ethernet oam discovery Field Descriptions

Field	Description
Administrative configurations	
Mode	Active or passive mode of the interface
Unidirection	Operational mode
Link monitor	Status of link monitor support
Remote loopback	Status of remote loopback support
MIB retrieval	Capability of requesting MIB objects.
Mtu size	Size of the maximum transmission unit
Operational status	
Port status	Operational state of the port
Loopback status	Operational status of the loopback interface
PDU revision	Revision of the OAM configuration. A new revision results from each change to the configuration.
Remote client	
MAC address	MAC address of the remote client
Vendor (oui)	Vendor number in hexidecimal

Related Commands

Command	Description
show ethernet oam statistics	Displays detailed information about Ethernet OAM packets.
show ethernet oam status	Displays Ethernet OAM configurations for all interfaces or for a specific interface.
show ethernet oam summary	Displays active Ethernet OAM sessions.

show ethernet oam statistics

To display detailed information about Ethernet operations, maintenance, and administration (OAM) packets, use the **show ethernet oam statistics** command in privileged EXEC mode.

show ethernet oam statistics [**interface** *type number*]

Syntax Description

interface	(Optional) Specifies an interface.
type	(Optional) Type of Ethernet interface. Valid values are: FastEthernet, GigabitEthernet, TenGigabitEthernet.
number	(Optional) Integer from 1 to 9 that is the number of the Ethernet interface.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Statistics that this command displays include the following:

- Rx/Tx OAM Protocol Data Unit (PDU) counters
- Link monitoring events, including event logs, if available
- Remote fault detection events
- Remote loopback events

Examples

The following example shows output from a **show ethernet oam statistics** command for interface GigabitEthernet 6/11:

```
Router# show ethernet oam statistics interface gigabitethernet 6/11

GigabitEthernet6/11
Counters:
---------
  Information OAMPDU Tx                   : 9723
  Information OAMPDU Rx                   : 9712
  Unique Event Notification OAMPDU Tx     : 0
  Unique Event Notification OAMPDU Rx     : 0
  Duplicate Event Notification OAMPDU TX  : 0
  Duplicate Event Notification OAMPDU RX  : 0
  Loopback Control OAMPDU Tx              : 0
  Loopback Control OAMPDU Rx              : 0
  Variable Request OAMPDU Tx              : 0
```

```
  Variable Request OAMPDU Rx              : 0
  Variable Response OAMPDU Tx             : 0
  Variable Response OAMPDU Rx             : 0
  Cisco OAMPDU Tx                         : 0
  Cisco OAMPDU Rx                         : 0
  Unsupported OAMPDU Tx                   : 0
  Unsupported OAMPDU Rx                   : 0
  Frames Lost due to OAM                  : 0

Local event logs:
-----------------
  0 Errored Symbol Period records
  0 Errored Frame records
  0 Errored Frame Period records
  0 Errored Frame Second records

Remote event logs:
------------------
  0 Errored Symbol Period records
  0 Errored Frame records
  0 Errored Frame Period records
  0 Errored Frame Second records
```

Table 1-34 describes the significant fields shown in the display.

Table 1-34 show ethernet oam statistics Field Descriptions

Field	Description
Counters	
Information OAMPDU Tx	Number of OAM PDUs transmitted
Information OAMPDU Rx	Number of OAM PDUs received
Unique Event Notification OAMPDU Tx	Number of unique event notification OAM PDUs transmitted
Unique Event Notification OAMPDU Rx	Number of unique event notification OAM PDUs received
Duplicate Event Notification OAMPDU Tx	Number of duplicate event notification OAM PDUs transmitted
Duplicate Event Notification OAMPDU Rx	Number of duplicate event notification OAM PDUs received
Loopback Control OAMPDU Tx	Number of loopback control OAM PDUs transmitted
Loopback Control OAMPDU Rx	Number of loopback control OAM PDUs received
Variable Request OAMPDU Tx	Number of OAM PDUs sent to request MIB objects on a remote device
Variable Request OAMPDU Rx	Number of OAM PDUs received and requesting MIB objects on a local device
Variable Response OAMPDU Tx	Number of OAM PDUs sent by the local device in response to a request from a remote device
Variable Response OAMPDU Rx	Number of OAM PDUs sent by the remote device in response to a request from a local device
Cisco OAMPDU Tx	Number of Cisco specific OAM PDUs sent
Cisco OAMPDU Rx	Number of Cisco specific OAM PDUs received

Table 1-34 show ethernet oam statistics Field Descriptions (continued)

Field	Description
Unsupported OAMPDU Tx	Number of unsupported OAM PDUs sent
Unsupported OAMPDU Rx	Number of unsupported OAM PDUs received
Frames lost due to OAM	Number of frames discarded by the OAM client
Local event logs	Log of events on the local device
Remote event logs	Log of events on the remote device

Related Commands

Command	Description
show ethernet oam discovery	Displays discovery information for all Ethernet OAM interfaces or for a specific interface.
show ethernet oam status	Displays Ethernet OAM configurations for all interfaces or for a specific interface.
show ethernet oam summary	Displays active Ethernet OAM sessions.

show ethernet oam status

To display Ethernet operations, maintenance, and administration (OAM) configurations for all interfaces or for a specific interface, use the **show ethernet oam status** command in privileged EXEC mode.

show ethernet oam status [**interface** *type number*]

Syntax Description

interface	(Optional) Specifies an interface.
type	(Optional) Type of Ethernet interface. Valid values are: FastEthernet, GigabitEthernet, TenGigabitEthernet.
number	(Optional) Integer from 1 to 9 that is the number of the Ethernet interface.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to display the runtime settings of link-monitoring and general OAM operations for all interfaces or for a specific interface.

OAM must be operational on the interface or interfaces before you issue this command.

Examples

The following example shows output from a **show ethernet oam status** command for interface GigabitEthernet 6/11:

```
Router# show ethernet oam status interface gigabitethernet 6/11

GigabitEthernet6/11
General
-------
  Mode:                  active
  PDU max rate:          10 packets per second
  PDU min rate:          1 packet per 1 second
  Link timeout:          5 seconds
  High threshold action: no action

Link Monitoring
---------------
  Status: supported (on)

  Symbol Period Error
    Window:              1 million symbols
    Low threshold:       1 error symbol(s)
```

```
    High threshold:      none

  Frame Error
    Window:              10 x 100 milliseconds
    Low threshold:       1 error frame(s)
    High threshold:      none

  Frame Period Error
    Window:              1 x 100,000 frames
    Low threshold:       1 error frame(s)
    High threshold:      none

  Frame Seconds Error
    Window:              600 x 100 milliseconds
    Low threshold:       1 error second(s)
    High threshold:      none
```

Table 1-35 describes the significant fields shown in the display.

Table 1-35 show ethernet oam status Field Descriptions

Field	Description
General	
Mode	Active or passive mode of the interface.
PDU max rate	Maximum number of protocol data units (PDUs) transmitted per second.
PDU min rate	Minimum number of PDUs transmitted per second.
Link timeout	Amount of time with inactivity before the link is dropped.
High threshold action	Action that occurs when the high threshold for an error is exceeded.
Link Monitoring	
Status	Operational state of the port.
Symbol Period Error	
Window	Specified number of error symbols.
Low threshold	Minimum number of error symbols.
High threshold	Maximum number of error symbols.
Frame Error	
Window	Specified amount of time in milliseconds.
Low threshold	Minimum number of error frames.
High threshold	Maximum number of error frames.
Frame Period Error	
Window	Frequency at which the measurement is taken, in milliseconds.
Low threshold	Minimum number of error frames.
High threshold	Maximum number of error frames.
Frame Seconds Error	

Table 1-35 show ethernet oam status Field Descriptions (continued)

Field	Description
Window	Frequency at which the measurement is taken, in milliseconds.
Low threshold	Lowest value at which an event will be triggered.
High threshold	Highest value at which an event will be triggered.

Related Commands

Command	Description
show ethernet oam discovery	Displays discovery information for all Ethernet OAM interfaces or for a specific interface.
show ethernet oam statistics	Displays detailed information about Ethernet OAM packets.
show ethernet oam summary	Displays active Ethernet OAM sessions.

show ethernet oam summary

To display active Ethernet operations, maintenance, and administration (OAM) sessions on a device, use the **show ethernet oam summary** command in privileged EXEC mode.

show ethernet oam summary

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(15)T	This command was integrated into Cisco IOS Release 12.4(15)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows output from a **show ethernet oam summary** command:

```
Router# show ethernet oam summary

Symbols:          * - Master Loopback State,  # - Slave Loopback State
Capability codes: L - Link Monitor,  R - Remote Loopback
                  U - Unidirection,  V - Variable Retrieval

  Local                         Remote
Interface       MAC Address    Vendor Mode    Capability

  Fa3/1         0080.09ff.e4a0 00000C active   L R
  Gi6/11        0030.96fd.6bfa 00000C active   L R
```

Table 1-36 describes the significant fields shown in the display.

Table 1-36 show ethernet oam summary Field Descriptions

Field	Description
Local Interface	Type of local interface
MAC Address	MAC address of the local interface
Remote Vendor	The vendor for the remote device.
Mode	Operational state of the local interface
Capability	Functions the local interface can perform

Related Commands

Command	Description
show ethernet oam discovery	Displays discovery information for all Ethernet OAM interfaces or for a specific interface.
show ethernet oam status	Displays Ethernet OAM configurations for all interfaces or for a specific interface.
show ethernet oam statistics	Displays detailed information about Ethernet OAM packets.

show interface accounting

To display a summary of traffic counters by interface type, use the **show interface accounting** command in user EXEC or privileged EXEC mode.

show interface accounting

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Examples

The following example shows how to display a summary of interface counters.

```
Router# show interface accounting
Protocol    Pkts In   Chars In   Pkts Out  Chars Out
Other               0          0           0              0
ESMC                0          0           0              0
```

show interface rep

Use the **show interface rep** User EXEC command to display Resilient Ethernet Protocol (REP) configuration and status for a specified interface or for all interfaces.

show interface [*interface-id***] rep [detail]** [| {**begin** | **exclude** | **include**} *expression*]

Syntax Description

interface-id	(Optional) Display REP configuration and status for a specified physical interface or port channel ID.
detail	(Optional) Display detailed REP configuration and status information.
| begin	(Optional) Display begins with the line that matches the *expression*.
| exclude	(Optional) Display excludes lines that match the *expression*.
| include	(Optional) Display includes lines that match the specified *expression*.
expression	Expression in the output to use as a reference point.

Command Modes

User EXEC

Command History

Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was updated to display information for REP no-neighbor interfaces. The command output displays a * to indicate a no-neighbor interfaces; with the detail keyword, the command output displays **No-Neighbor** next to no-neighbor interfaces. This command was also updated to display the LSL ageout timer in the output.

Usage Guidelines

In the output for the **show interface rep** [**detail**] command, in addition to an *Open*, *Fail*, or AP (alternate port) state, the Port Role might show as *Fail Logical Open* (*FailLogOpen*) or *Fail No Ext Neighbor* (*FailNoNbr*). These states indicate that the port is physically up, but REP is not configured on the neighboring port. In this case, one port goes into a forwarding state for the data path to help maintain connectivity during configuration. The Port Role for this port shows as Fail Logical Open; the port forwards all data traffic on all VLANs. The other failed Port Role shows as *Fail No Ext Neighbor;* this port blocks traffic for all VLANs.

When the external neighbors for the failed ports are configured, the failed ports go through the alternate port state transitions and eventually go to an Open state or remain as the alternate port, based on the alternate port election mechanism.

The output of this command is also included in the **show tech-support** privileged EXEC command output.

Expressions are case sensitive. For example, if you enter **| exclude output**, the lines that contain *output* are not displayed, but the lines that contain *Output* are displayed.

Examples

This is sample output from the **show interface rep** command:

```
Switch # show interface rep
Interface                Seg-id   Type        LinkOp     Role
---------------------- ------ ------------ ----------- ----
GigabitEthernet 0/1        1    Primary Edge  TWO_WAY    Open
GigabitEthernet 0/2        1    Edge          TWO_WAY    Open
FastEthernet 0/4           2                  INIT_DOWN  Fail
```

This is sample output from the **show interface rep** command when the edge port is configured to have no REP neighbor. Note the asterisk (*) next to *Primary Edge*.

```
Router# show interface rep
Interface              Seg-id Type             LinkOp      Role
---------------------- ------ --------------  ----------- ----
GigabitEthernet0/1     2                      TWO_WAY     Open
GigabitEthernet0/2     2      Primary Edge*   TWO_WAY     Open
```

This is sample output from the **show interface rep** command when external neighbors are not configured:

```
Switch # show interface rep
Interface                Seg-id   Type        LinkOp     Role
---------------------- ------ ------------ ----------- ----
GigabitEthernet0/1         1                NO_NEIGHBOR FailNoNbr
GigabitEthernet0/2         2                NO_NEIGHBOR FailLogOpen
```

This is sample output from the **show interface rep detail** command for a specified interface:

```
Switch # show interface gigabitethernet0/2 rep detail
GigabitEthernet0/2   REP enabled
Segment-id: 1 (Segment)
PortID: 00030019E85BDD00
Preferred flag: No
Operational Link Status: INIT_DOWN
Current Key: 00000000000000000000
Port Role: Fail
Blocked VLAN: 1-4094
Admin-vlan: 1
Preempt Delay Timer: disabled
LSL Ageout Timer: 5000 ms
Configured Load-balancing Block Port: 1234567890123456
Configured Load-balancing Block VLAN: 1-4094
STCN Propagate to: none
LSL PDU rx: 0, tx: 0
HFL PDU rx: 0, tx: 0
BPA TLV rx: 0, tx: 0
BPA (STCN, LSL) TLV rx: 0, tx: 0
BPA (STCN, HFL) TLV rx: 0, tx: 0
EPA-ELECTION TLV rx: 0, tx: 0
EPA-COMMAND TLV rx: 0, tx: 0
EPA-INFO TLV rx: 0, tx: 0
```

Related Commands

Command	Description
rep segment	Enables REP on an interface and assigns a segment ID. This command is also used to configure a port as an edge port, a primary edge port, or a preferred port.
show rep topology [**detail**]	Displays information about all ports in the segment, including which one was configured and selected as the primary edge port.

show interface switchport backup

Displays status information about the backup switchport.

show interface switchport backup

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(19)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows the output generated by this command:

```
Router# show interface switchport backup

Switch Backup Interface Pairs:

Active Interface        Backup Interface        State
------------------------------------------------------------------------
GigabitEthernet0/0      GigabitEthernet0/5      Active Down/Backup Down
```

Related Commands

Command	Description
switchport backup interface	Configures a backup interface pair.

show ip cef exact-route

To display the exact route for a source-destination IP address pair, use the **show ip cef exact-route** command in user EXEC or privileged EXEC mode.

show ip cef [**vrf** *vrf-name*] **exact-route** *source-address* [**platform**] *destination-address*

Syntax Description

vrf	(Optional) A Virtual Private Network (VPN) routing and forwarding (VRF) instance.
vrf-name	(Optional) Name assigned to the VRF.
source-address	The network source address.
platform	Displays the exact route for a hardware session.
destination-address	The network destination address.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
12.1(4)T	This command was introduced.
12.2(25)S	Command output was reformatted.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(11)T	The **src-port** *port-number* and **dest-port** *port-number* keywords and arguments were added.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)T	This command was integrated into Cisco IOS Release 12.4(20)T.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **src-port** or **dest-port** keywords.

Usage Guidelines

When you are load balancing per destination, this command shows the exact next hop that is used for a given IP source-destination pair.

If you configured the **ip cef load-sharing algorithm include-ports** command and the **source**, **destination**, or **source destination** keywords, you can use the source port number or the destination port number or both port numbers to see the load-balancing decision for a source and destination address. These options are available only if the include-ports algorithm is enabled.

Examples

Sample Output for Cisco IOS Releases 12.2(25)S, 12.2(28)SB, 12.2(33)SRA, 12.2(33)SXH, 12.4(20)T, and Later Releases

The following sample output is from the **show ip cef exact-route** command:

```
Router# show ip cef exact-route 172.16.1.3 172.16.1.2
```

```
172.16.1.3 -> 172.16.1.2 => IP adj out of FastEthernet0/1, addr  172.17.25.1
```

Table 1-37 describes the significant fields shown in the display.

Table 1-37 show ip cef exact-route Field Descriptions

Field	Description
172.16.1.3 -> 172.16.1.2	From source 172.16.1.3 to destination 172.16.1.2
FastEthernet0/1,	Next hop is out interface FastEthernet0/1
addr 172.17.25.1	IP address of the next hop is 172.17.25.1

Sample Output for Cisco IOS Releases Before Cisco IOS Release 12.2(25)S

The following sample output is from the **show ip cef exact-route** command:

```
Router# show ip cef exact-route 10.1.1.1 172.17.249.252

10.1.1.1          -> 172.17.249.252 :Ethernet2/0/0 (next hop 10.1.104.1)
```

Table 1-38 describes the significant fields shown in the display.

Table 1-38 show ip cef exact-route Field Descriptions

Field	Description
10.1.1.1 -> 172.17.249.252	From source 10.1.1.1 to destination 172.17.249.252.
Ethernet2/0/0 (next hop 10.1.104.1)	Next hop is 10.1.104.1 on Ethernet 2/0/0.

Related Commands

Command	Description
ip cef load-sharing algorithm	Selects a Cisco Express Forwarding load-balancing algorithm.

show ip mroute

To display the contents of the multicast routing (mroute) table, use the show ip mroute command in user EXEC or privileged EXEC mode.

Note The Cisco MWR 2941 only supports multicast routing for PTP redundancy. For more information, see the *Cisco MWR 2941-DC Mobile Wireless Edge Router Software Configuration Guide.*

show ip mroute [vrf *vrf-name*] **[[active [***kbps*] **[interface** *type number*] **| bidirectional | count [terse] | dense | interface** *type number* **| proxy | pruned | sparse | ssm | static | summary] | [***group-address* **[***source-address*]] **[count [terse] | interface** *type number* **| proxy | pruned | summary] | [***source-address group-address*] **[count [terse] | interface** *type number* **| proxy | pruned | summary] | [***group-address*] **active [kbps] [interface** *type number*]]

Syntax Description

vrf *vrf-name*	(Optional) Filters the output to display only the contents of the mroute table that pertain to the Multicast Virtual Private Network (MVPN) routing and forwarding (MVRF) instance specified for the vrf-name argument.
active *kbps*	(Optional) Displays the rate that active sources are sending to multicast groups, in kilobits per second (kbps). Active sources are those sending at the kbps value or higher. The range is from 1 to 4294967295. The kbps default is 4 kbps.
interface type number	(Optional) Filters the output to display only mroute table information related to the interface specified for the type number arguments.
bidirectional	(Optional) Filters the output to display only information about bidirectional routes in the mroute table.
count	(Optional) Displays statistics about the group and source, including number of packets, packets per second, average packet size, and bytes per second.
terse	(Optional) Filters the output to display a subset of mroute statistics, excluding source and group statistics for each mroute entry in the mroute table.
dense	(Optional) Filters the output to display only information about dense mode routes in the mroute table.
proxy	(Optional) Displays information about Reverse Path Forwarding (RPF) vector proxies received on a multicast router.
pruned	(Optional) Filters the output to display only information about pruned routes in the mroute table.
sparse	(Optional) Filters the output to display only information about sparse mode routes in the mroute table.
ssm	(Optional) Filters the output to display only the Source Specific Multicast (SSM) routes in the mroute table.
static	(Optional) Filters the output to display only the static routes in the mroute table.
summary	(Optional) Filters the output to display a one-line, abbreviated summary of each entry in the mroute table.

group-address	(Optional) IP address or Domain Name System (DNS) name of a multicast group.
source-address	(Optional) IP address or DNS name of a multicast source.

Command Modes

User EXEC, Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	The H flag for multicast multilayer switching (MMLS) was added in the output display.
12.1(3)T	The U, s, and I flags for Source Specific Multicast (SSM) were introduced.
12.0(23)S	The **vrf** keyword and *vrf-name* argument were added.
12.0(30)S	The **proxy** keyword, and the v and V flags were added for the Multicast VPN Inter-AS Support feature.
12.2(13)T	The **vrf** keyword and *vrf-name* argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S. The **vrf** keyword and *vrf-name* argument were added
12.3	The Z, Y, and y flags were introduced.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.
12.4(6)T	The **terse** keyword was added.
12.4(7)	The **terse** keyword was added.
12.2(18)SXF2	The **terse** keyword was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA. The **terse** keyword was added. The **proxy** keyword, and the v and V flags were added for the Multicast VPN Inter-AS Support feature.
12.2(31)SB2	The E flag for the Multicast VPN Extranet Support feature was introduced. The **proxy** keyword, and the v and V flags were added for the Multicast VPN Inter-AS Support feature. The **terse** keyword was added.
12.2(33)SXH	The **proxy** keyword, and the v and V flags were added for the Multicast VPN Inter-AS Support feature.
12.2(33)SRC	The E flag for the Multicast VPN Extranet Support feature was introduced.
12.4(20)T	The **proxy** keyword, and the v and V flags were added for the Multicast VPN Inter-AS Support feature.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show ip mroute** command to display information about mroute entries in the mroute table. The Cisco IOS software populates the multicast routing table by creating (S, G) entries from (*, G) entries. The asterisk (*) refers to all source addresses, the "S" refers to a single source address, and the "G" is the destination multicast group address. In creating (S, G) entries, the software uses the best path to that destination group found in the unicast routing table (that is, through Reverse Path Forwarding [RPF]).

Use the **clear ip mroute** command to delete entries from the mroute table.

Examples

The following is sample output from the **show ip mroute** command for a router operating in sparse mode:

```
Router# show ip mroute

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel,
       Y - Joined MDT-data group, y - Sending to MDT-data group
Timers: Uptime/Expires
Interface state: Interface, Next-Hop, State/Mode

(*, 224.0.255.3), uptime 5:29:15, RP is 192.168.37.2, flags: SC
  Incoming interface: Tunnel0, RPF neighbor 10.3.35.1, Dvmrp
  Outgoing interface list:
    Ethernet0, Forward/Sparse, 5:29:15/0:02:57

(192.168.46.0, 224.0.255.3), uptime 5:29:15, expires 0:02:59, flags: C
  Incoming interface: Tunnel0, RPF neighbor 10.3.35.1
  Outgoing interface list:
    Ethernet0, Forward/Sparse, 5:29:15/0:02:57
```

The following is sample output from the **show ip mroute** command with the IP multicast group address 232.6.6.6 specified:

```
Router# show ip mroute 232.6.6.6

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel,
       Y - Joined MDT-data group, y - Sending to MDT-data group
Outgoing interface flags:H - Hardware switched
Timers:Uptime/Expires
Interface state:Interface, Next-Hop or VCD, State/Mode

(*, 232.6.6.6), 00:01:20/00:02:59, RP 224.0.0.0, flags:sSJP
  Incoming interface:Null, RPF nbr 224.0.0.0
  Outgoing interface list:Null

(10.2.2.2, 232.6.6.6), 00:01:20/00:02:59, flags:CTI
  Incoming interface:Ethernet3/3, RPF nbr 224.0.0.0
  Outgoing interface list:
    Ethernet3/1, Forward/Sparse-Dense, 00:00:36/00:02:35
```

The following is sample output from the **show ip mroute** command for a router operating in dense mode. This output displays the contents of the IP multicast routing table for the multicast group named cbone-audio.

```
Router# show ip mroute cbone-audio

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
```

```
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel,
       Y - Joined MDT-data group, y - Sending to MDT-data group
Timers: Uptime/Expires
Interface state: Interface, Next-Hop, State/Mode

(*, 224.0.255.1), uptime 0:57:31, expires 0:02:59, RP is 224.0.0.0, flags: DC
  Incoming interface: Null, RPF neighbor 224.0.0.0, Dvmrp
  Outgoing interface list:
    Ethernet0, Forward/Dense, 0:57:31/0:02:52
    Tunnel0, Forward/Dense, 0:56:55/0:01:28

(192.168.37.100, 224.0.255.1), uptime 20:20:00, expires 0:02:55, flags: C
  Incoming interface: Tunnel0, RPF neighbor 10.20.37.33, Dvmrp
  Outgoing interface list:
    Ethernet0, Forward/Dense, 20:20:00/0:02:52
```

The following is sample output from the **show ip mroute** command that shows the virtual circuit descriptor (VCD) value, because an ATM interface with Protocol Independent Multicast (PIM) multipoint signaling is enabled:

```
Router# show ip mroute 224.1.1.1

IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel,
       Y - Joined MDT-data group, y - Sending to MDT-data group
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 224.1.1.1), 00:03:57/00:02:54, RP 172.16.0.0, flags: SJ
  Incoming interface: Null, RPF nbr 224.0.0.0224.0.0.0
  Outgoing interface list:
    ATM0/0, VCD 14, Forward/Sparse, 00:03:57/00:02:53
```

For more information about the show ip mroute command, see the Cisco IOS IP Multicast Command Reference.

Related Commands

Command	Description
clear ip mroute	Deletes entries from the mroute table.

show ip rtp header-compression

To show Real-Time Transport Protocol (RTP) header compression statistics, use the **show ip rtp header-compression** command in privileged EXEC mode.

show ip rtp header-compression [*type number*] [**detail**]

Syntax Description

type number	(Optional) Interface type and number.
detail	(Optional) Displays details of each connection. **Note** This keyword is not supported on the Cisco MWR 2941 router. See "Usage Guidelines."

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3	This command was introduced.
12.1(5)T	The command output was modified to include information related to the Distributed Compressed Real-Time Transport Protocol (dCRTP) feature.
12.3(11)T	The command output was modified to include information related to the Enhanced Compressed Real-Time Transport Protocol (ECRTP) feature.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR and the "efficiency improvement factor" field was added to the command output.

Usage Guidelines

Use the **show ip rtp header-compression** command and specify the **multilink** keyword option to display RTP/UDP/IP header compression statistics.

The **detail** keyword is not available with the **show ip rtp header-compression** command on a Route Switch Processor (RSP). However, the **detail** keyword is available with the **show ip rtp header-compression** command on a Versatile Interface Processor (VIP).

Enter the **show ip rtp header-compression** *type number* **detail** command on a VIP to retrieve detailed information about RTP header compression on a specific interface.

Examples

The following example shows output from the **show ip rtp header-compression** command for a multilink interface:

```
Router#show ip rtp header-compression multilink 1
RTP/UDP/IP header compression statistics:
  Interface Multilink1 (compression on, IETF)
  Distributed fast switched:
  2 seconds since line card sent last stats update
    Rcvd:    97720497 total, 97658367 compressed, 0 errors, 0 status msgs
             0 dropped, 0 buffer copies, 0 buffer failures
    Sent:    98315457 total, 97663468 compressed, 0 status msgs, 0 not predicted
             2148596296 bytes saved, 3966846342 bytes sent
             1.54 efficiency improvement factor
    Connect: 16 rx slots, 16 tx slots,
             0 misses, 0 collisions, 0 negative cache hits, 0 free contexts
             100% hit ratio, five minute miss rate 0 misses/sec, 0 max

Router#
```

Table 1-39 describes the significant fields shown in the display.

Table 1-39 show ip rtp header-compression Field Descriptions

Field	Description
Interface	Type and number of the interface and the type of header compression enabled on the interface, if any.
Distributed fast switched	
Rcvd:	
total	Number of packets received on the interface.
compressed	Number of packets with compressed headers.
errors	Number of errors.
dropped	Number of dropped packets.
buffer copies	Not applicable to the Cisco MWR 2941 router.
buffer failures	Not applicable to the Cisco MWR 2941 router.
Sent:	
total	Total number of packets sent.
compressed	Number of packets sent with compressed headers.
bytes saved	Total savings in bytes as a result of compression.
bytes sent	Not applicable to the Cisco MWR 2941 router.
efficiency improvement factor	Percentage of increased bandwidth efficiency as a result of header compression.
Connect:	
rx slots	Total number of receive slots.
tx slots	Total number of transmit slots.
long searches	Not applicable to the Cisco MWR 2941 router.
misses	Number of new states that were created.
hit ratio	Number of times that existing states were revised.

Table 1-39 show ip rtp header-compression Field Descriptions (continued)

Field	Description
five minute miss rate	Average miss rate.
max.	Maximum miss rate.
negative cache	Not applicable to the Cisco MWR 2941 router.

Related Commands

Command	Description
ip rtp compression-connections	Specifies the total number of RTP header compression connections that can exist on an interface.
ip rtp header-compression	Enables RTP header compression.

show ip sla twamp connection

Use the **show ip sla twamp connection** command in user EXEC mode to display the current Cisco IOS IP Service Level Agreements (SLAs) Two-Way Active Measurement Protocol (TWAMP) connections.

show ip sla twamp connection {**detail** [**source-ip** *ip-address*] | **requests**} [| {**begin** | **exclude** | **include**} *expression*]

Syntax Description

detail	Display current connection details.
source-ip *ip-address*	(Optional) Display connection details from a specific TWAMP connection.
requests	Display current connection requests.
| begin	(Optional) Display begins with the line that matches the *expression*.
| exclude	(Optional) Display excludes lines that match the *expression*.
| include	(Optional) Display includes lines that match the specified *expression*.
expression	Expression in the output to use as a reference point.

Defaults

Displays output for all running IP SLAs TWAMP sessions.

Command Modes

User EXEC

Command History

Release	Modification
12.2(52)SE	This command was introduced.
15.1(1)MR	This command was integrated into Cisco IOS Release 15.1(1)MR.

Usage Guidelines

Use the **detail** keyword to display detailed information for a single IP SLAs TWAMP connection.

Use the **requests** keyword to display the current IP SLAs TWAMP connection requests.

Expressions are case sensitive. For example, if you enter **| exclude output**, the lines that contain *output* are not displayed, but the lines that contain *Output* are displayed.

Examples

The following is sample output from the **show ip sla twamp connection detail** command:

```
Router# show ip sla twamp connection detail
Connection Id:          91
    Client IP Address:    172.27.111.225
    Client Port:          43026
    Mode:                 Unauthenticated
    Connection State:     Connected
    Control State:        None
    Number of Test Requests - 0:1
```

The following is sample output from the **show ip sla twamp connection requests** command:

```
Router# show ip sla twamp connection requests
Connection-Id        Client Address   Client Port
       91        172.27.111.225         43026
Total number of current connections: 1
```

Related Commands

Command	Description
show ip sla standards	Displays the TWAMP server and reflector standards implemented on the switch.
show ip sla twamp session	Displays IP SLAs TWAMP sessions.

show ip sla twamp session

Use the **show ip sla twamp session** command in user EXEC mode to display Cisco IOS IP Service Level Agreements (SLAs) Two-Way Active Measurement Protocol (TWAMP) test sessions.

show ip sla twamp session [**source-ip** *ip address* | **source-port** *port-number*] [| {**begin** | **exclude** | **include**} *expression*]

Syntax Description

source-ip *ip-address*	(Optional) Display results from the TWAMP test session on the specified IP address.
source-port *port-number*	(Optional) Display results from the TWAMP test session on the specified port.
| begin	(Optional) Display begins with the line that matches the *expression*.
| exclude	(Optional) Display excludes lines that match the *expression*.
| include	(Optional) Display includes lines that match the specified *expression*.
expression	Expression in the output to use as a reference point.

Defaults

Displays the IP SLAs TWAMP test sessions and results.

Command Modes

User EXEC

Command History

Release	Modification
12.2(52)SE	This command was introduced.
15.1(1)MR	This command was integrated into Cisco IOS Release 15.1(1)MR.

Usage Guidelines

Use the **show ip sla twamp session** command to display information about IP SLAs TWAMP test sessions.

Expressions are case sensitive. For example, if you enter **| exclude output**, the lines that contain *output* are not displayed, but the lines that contain *Output* are displayed.

Examples

The following is sample output from the **show ip sla twamp session** command:

```
Router# show ip sla twamp session
    IP SLAs Responder TWAMP is: Enabled
    Recvr Addr: 172.27.117.116
    Recvr Port: 3619
    Sender Addr: 172.27.111.225
    Sender Port: 32910
    Session Id: 172.27.117.116:533112:9C41EC42
    Connection Id: 95
```

Related Commands

Command	Description
show ip sla standards	Displays the TWAMP server and reflector standards implemented on the switch.
show ip sla twamp connection {**detail** | **requests**}	Displays IP SLAs TWAMP connections.

show ip sla twamp standards

Use the **show ip sla twamp standards** command in user EXEC or privileged EXEC mode to display the Two-Way Active Measurement Protocol (TWAMP) standards implemented on the router.

show ip sla twamp standards

Syntax Description

This command has no arguments or keywords.

Defaults

Displays the IP SLAs and TWAMP standards implemented on the switch.

Command Modes

User EXEC

Command History

Release	Modification
15.1(1)MR	This command was introduced.

Usage Guidelines

Use the **show ip sla twamp standards** command to display the IP SLAs TWAMP standards implemented on the router.

Examples

The following is sample output from the **show ip sla twamp standards** command:

```
Router# show ip sla twamp standards
Feature                   Organization    Standard
TWAMP Server              IETF            draft-ietf-ippm-twamp-06
TWAMP Reflector           IETF            draft-ietf-ippm-twamp-06
```

Related Commands

Command	Description
show ip sla twamp connection {**detail** | **requests**}	Displays IP SLAs TWAMP connections.
show ip sla twamp session	Displays IP SLAs TWAMP sessions.

show ip tcp header-compression

Note The Cisco MWR 2941 supports UDP header-compression in IEFT format only.

To display Transmission Control Protocol (TCP)/IP header compression statistics, use the **show ip tcp header-compression** command in user EXEC or privileged EXEC mode.

show ip tcp header-compression [*interface-type interface-number*] [**detail**]

Syntax Description

interface-type interface-number	(Optional) The interface type and number.
detail	(Optional) Displays details of each connection. This keyword is available only in privileged EXEC mode.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
10.0	This command was introduced.
12.4	This command was integrated into Cisco Release 12.4 and its command output was modified to include additional compression statistics.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following is sample output from the **show ip tcp header-compression** command:

```
Router# show ip tcp header-compression

TCP/IP header compression statistics:
  Interface Serial2/0 (compression on, IETF)
    Rcvd:    53797 total, 53796 compressed, 0 errors, 0 status msgs
             0 dropped, 0 buffer copies, 0 buffer failures
    Sent:    53797 total, 53796 compressed, 0 status msgs, 0 not predicted
             1721848 bytes saved, 430032 bytes sent
             5.00 efficiency improvement factor
    Connect: 16 rx slots, 16 tx slots,
             1 misses, 0 collisions, 0 negative cache hits, 15 free contexts
             99% hit ratio, five minute miss rate 0 misses/sec, 0 max
```

Table 1-40 describes significant fields shown in the display.

Table 1-40 show ip tcp header-compression Field Descriptions

Field	Description
Interface e12/0 (compression on, IETF)	Interface type and number on which compression is enabled.
Rcvd:	Received statistics described in subsequent fields.
total	Total number of TCP packets received on the interface.
compressed	Total number of TCP packets compressed.
errors	Number of packets received with errors.
status msgs	Number of resynchronization messages received from the peer.
dropped	Number of packets dropped due to invalid compression.
buffer copies	Number of packets that needed to be copied into bigger buffers for decompression.
buffer failures	Number of packets dropped due to a lack of buffers.
Sent:	Sent statistics described in subsequent fields.
total	Total number of TCP packets sent on the interface.
compressed	Total number of TCP packets compressed.
status msgs	Number of resynchronization messages sent from the peer.
not predicted	Number of packets taking a non-optimal path through the compressor.
bytes saved	Total savings in bytes due to compression.
bytes sent	Total bytes sent after compression.
efficiency improvement factor	Improvement in line efficiency because of TCP header compression.
Connect:	Connection statistics described in subsequent fields.
rx slots	Total number of receive slots.
tx slots	Total number of transmit slots.
misses	Indicates the number of times a match could not be made. If your output shows a large miss rate, then the number of allowable simultaneous compression connections may be too low.
collisions	Total number of collisions.
negative cache hits	Total number of negative cache hits. **Note** This field is not relevant for TCP header compression; it is used for Real-Time Transport Protocol (RTP) header compression.
free contexts	Total number of free contexts. **Note** Free contexts (also known as connections) are an indication of the number of resources that are available, but not currently in use, for TCP header compression.
hit ratio	Percentage of times the software found a match and was able to compress the header.

Table 1-40 show ip tcp header-compression Field Descriptions (continued)

Field	Description
Five minute miss rate in misses/sec	Calculates the miss rate over the previous five minutes for a longer-term (and more accurate) look at miss rate trends.
max	Maximum value of the previous field.

Related Commands

Command	Description
ip tcp compression-connections	Specifies the total number of TCP header compression connections that can exist on an interface

show l2protocol-tunnel

To display the protocols that are tunneled on an interface or on all interfaces, use the **show l2protocol-tunnel** command.

show l2protocol-tunnel [{**interface** *interface mod/port*} | **summary**}]

Syntax Description

interface *interface*	(Optional) Specifies the interface type; only **gigabitethernet** is supported
mod/port	Module and port number.
summary	(Optional) Displays a summary of a tunneled port.

Command Default

This command has no default settings.

Command Modes

EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17a)SX	The **show l2protocol-tunnel summary** command output was changed to display the following information: • Global drop-threshold setting • Up status of a Layer 2-protocol interface tunnel
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to the 12.2 SX release.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXI	This command was changed to add the optional **vlan** *vlan* keyword and argument.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release only supports the **gigabitethernet** value with the **interface** keyword. This release does not support the **vlan** *vlan* keyword and argument.

Usage Guidelines

The **show l2protocol-tunnel** command displays only the ports that have protocol tunneling enabled.

The **show l2protocol-tunnel summary** command displays the ports that have protocol tunneling enabled, regardless of whether the port is down or currently configured as a trunk.

Examples

This example shows how to display the protocols that are tunneled on all interfaces:

```
Router# show l2protocol-tunnel
COS for Encapsulated Packets: 5
```

```
Drop Threshold for Encapsulated Packets: 3000
Port    Protocol Shutdown    Drop    Encapsulation Decapsulation     Drop
                 Threshold Threshold    Counter       Counter       Counter
------- -------- --------- --------- ------------- ------------- -------------
Fa3/38  cdp      ----      3000      5             0             0
        stp      ----      3000      2653          0             0
                 ---       ----      ----          ----          ----
Router#
```

This example shows how to display a summary of Layer 2-protocol tunnel ports:

```
Router# show l2protocol-tunnel summary

COS for Encapsulated Packets:5
Drop Threshold for Encapsulated Packets:0

Port    Protocol    Shutdown         Drop             Status
                    Threshold        Threshold
                    (cdp/stp/vtp)    (cdp/stp/vtp)
------- ----------- ---------------- ---------------- ----------
Fa9/1   --- stp --- ----/----/----   ----/----/----   down
Fa9/9   cdp stp vtp ----/----/----   ----/----/----   up
Fa9/47  --- --- --- ----/----/----   1500/1500/1500   down(trunk)
Fa9/48  cdp stp vtp ----/----/----   ----/----/----   down(trunk)
Router>
```

This example shows how to display Layer 2-protocol tunnel information on interfaces for a specific VLAN:

```
Router# show l2protocol-tunnel vlan 1

COS for Encapsulated Packets: 5
Drop Threshold for Encapsulated Packets: 0

Protocol Drop Counter
-------- -------------
 cdp                0
 lldp               0
 stp                0
 vtp                0

Port                Protocol Thresholds          Counters
                             Shutdown  Drop      Encap     Decap     Drop
------------------- -------- --------- --------- --------- --------- ---------

Router#
```

Related Commands

Command	Description
l2protocol-tunnel	Enables the protocol tunneling on an interface and specifies the type of protocol to be tunneled.
l2protocol-tunnel drop-threshold	Specifies the maximum number of packets that can be processed for the specified protocol on that interface before being dropped.
l2protocol-tunnel shutdown-threshold	Specifies the maximum number of packets that can be processed for the specified protocol on that interface in one second.

show link-protection

To display the status of configured link protection groups, use the **show link-protection** command in user EXEC or privileged EXEC mode.

show link-protection [detail [group *group-number*]]

Syntax Description

detail	Displays the details of the link protection status of each port.
group-number	Specifies a single link protection group to display.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

Use this command to configure Microwave 1+1 Hot Standby Protocol (HSBY). For more information about HSBY, see the *Cisco MWR 2941 Mobile Wireless Edge Router Software Configuration Guide, Release 15.0(1)MR*.

Examples

The following examples provide sample output from the **show link-protection** command:

```
Router# show link-protection
CFM Status: Enabled
------------------------------
Group:   Port:   ODU Status:
------------------------------
1        Gi0/1   Active
1        Gi0/2   Standby


Router# show link-protection detail

Management VLAN: 100
CFM Status: Enabled

Group: 1
----------------
Port: Gi0/1
Domain: ODU1
ECCM vlan: 1
PCCM vlan: 16
ODU Status: Active
ODU Radio: On
Data vlans: Forwarding

Port: Gi0/2
Domain: ODU2
ECCM vlan: 2
```

```
PCCM vlan: 16
ODU Status: Standby
ODU Radio: Off
Data vlans: Blocking
```

Related Commands

Command	Description
link protection-group	Specifies a link protection group for a MEP interface.

show link-protection statistics

To display the counters for each link protection port, use the **show link-protection statistics** command in user EXEC or privileged EXEC mode.

show link-protection statistics [interface *interface-name slot/port***]**

Syntax Description

interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot in which card is inserted.
port	The port of the card.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command only applies to Gigabit Ethernet interfaces.

Use this command to configure Microwave 1+1 Hot Standby Protocol (HSBY). For more information about HSBY, see the *Cisco MWR 2941 Mobile Wireless Edge Router Software Configuration Guide, Release 15.0(1)MR*.

Examples

The following examples provide sample output from the **show link-protection statistics** command:

```
Router# show link-protection statistics
Counters:
---------
Port: Gi0/1
Group: 1
TLV Rx: 683
TLV Tx: 685
TLV Rx: 0
Invalid TLV Rx: 0
Sender OK Rx: 0
Sender KO Rx: 0
Suspend Flag Rx: 0
ODU Failure: 1

Port: Gi0/2
Group: 1
TLV Rx: 680
TLV Tx: 698
Invalid TLV Rx: 0
Sender OK Rx: 0
Sender KO Rx: 0
Suspend Flag Rx: 0
ODU Failure: 1
```

Related Commands

Command	Description
link protection-group	Specifies a link protection group for a MEP interface.

show mac-address-table learning

To display the MAC-address learning state, use the **show mac-address-table learning** command in user EXEC mode.

show mac-address-table learning {**vlan** *vlan-id [*,*vlan-id* | **-***vlan-id]* | **interface** [*interface slot*/*port*]}

Syntax Description

vlan *vlan-id*	(Optional) Displays information about the MAC-address learning state for the specified switch port VLAN; valid values are from 1 to 4094.
interface *interface slot*/*port*	(Optional) Displays information about the MAC-address learning state for the specified routed interface type, the slot number, and the port number.

Command Default

This command has no default settings.

Command Modes

User EXEC (>)

Command History

Release	Modification
12.2(18)SXE	Support for this command was introduced on the Supervisor Engine 720.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **module** keyword.

Usage Guidelines

The **interface** *interface slot*/*port* keyword and arguments can be used on routed interfaces only. The **interface** *interface slot*/*port* keyword and arguments cannot be used to configure learning on switch-port interfaces.

If you specify the **vlan** *vlan-id*, the state of the MAC-address learning of the specified VLAN, including router interfaces, on all modules, is displayed.

If you specify the **vlan** *vlan-id* and the **module** *num*, the state of the MAC-address learning of a specified VLAN on a specified module is displayed.

If you specify the **interface** *interface slot*/*port* keyword and arguments, the state of the MAC-address learning of the specified interface on all modules is displayed.

If you specify the **interface** *interface slot*/*port* keyword and arguments, the state of the MAC-address learning of the specified interface on the specified module is displayed.

If you enter the **show mac-address-table learning** command with no arguments or keywords, the status of MAC learning on all the existing VLANs is displayed.

Examples

This example shows how to display the MAC-address learning status on all interfaces.

```
Router# show mac-address-table learning interface
```

```
Interface               Learning
------------------      --------
GigabitEthernet0/0      Disabled
GigabitEthernet0/1      Enabled
GigabitEthernet0/2      Disabled
GigabitEthernet0/3      Disabled
GigabitEthernet0/4      Disabled
GigabitEthernet0/5      Enabled
```

This example shows how to display the status of MAC-address learning for a specific interface.

```
Router# show mac address-table learning interface gigabitEthernet 0/0

Interface               Learning
------------------      --------
GigabitEthernet0/0      Enabled
```

This example shows how to display the status of MAC-address learning for a specific VLAN.

```
Router# show mac-address-table learning vlan 1

VLAN    Learning
----    --------
1       Enabled
```

This example shows how to display the status of MAC-address learning for multiple VLANs.

```
Router# show mac address-table learning vlan 688,788

VLAN    Learning
----    --------
688     Enabled
788     Disabled
```

This example shows how to display the status of MAC-address learning for a range of VLANs.

```
Router# show mac address-table learning vlan 689-690

VLAN    Learning
----    --------
689     Disabled
690     Enabled
```

Related Commands

Command	Description
mac-address-table learning	Enables MAC-address learning.

show mpls l2transport vc

To display information about Any Transport over MPLS (AToM) virtual circuits (VCs) that have been enabled to route Layer 2 packets on a router, use the **show mpls l2transport vc** command in privileged EXEC mode.

show mpls l2transport vc [vcid *vc-id*] **| [vcid** *vc-id-min vc-id-max*]**} [interface** *name* **[***local-circuit-id***]] [destination** *ip-address* **|** *name***] [detail]**

Syntax Description

vcid	(Optional) Allows you to enter a specific VC ID to display.
vc-id	(Optional) The VC ID number.
vc-id-min *vc-id-max*	(Optional) Allows you to enter a range of VCs to display. The range is from 1 to 4294967295. (This argument is primarily used for legacy implementations.)
interface	(Optional) The interface or subinterface of the router that has been enabled to transport Layer 2 packets. This keyword lets you display information about the VCs that have been assigned VC IDs on that interface or subinterface.
name	(Optional) The name of the interface or subinterface.
local-circuit-id	(Optional) The number assigned to the local circuit. This argument value is supported only by the following transport types: • For ATM adaptation layer 5 (AAL5) and cell relay, enter the virtual path identifier (VPI)/virtual channel identifier (VCI) of the PVC. • For Ethernet VLANs, enter the VLAN number.
destination	(Optional) Information about the VCs that have been assigned VC IDs for the remote router you specify.
ip-address	(Optional) The IP address of the remote router.
name	(Optional) The name assigned to the remote router.
detail	(Optional) Detailed information about the VCs that have been assigned VC IDs.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(8a)E	This command was introduced.
12.0(21)ST	This command was integrated into Cisco IOS Release 12.0(21)ST.
12.0(22)S	This command was implemented on the Cisco 10720 router.
12.0(23)S	The **interface** and **destination** keywords were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(14)SX	This command was implemented on the Supervisor Engine 720.
12.2(14)SZ	This command was integrated into Cisco IOS Release 12.2(14)SZ.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.
12.2(18)S	This command was implemented on Cisco 7304 routers.
12.0(25)S	This command was updated with new output and fields to display information about tunnel selection and ATM cell relay port mode.

Release	Modification
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(25)S	This command was updated with new output and fields for nonstop forwarding (NSF), stateful switchover (SSO), and graceful restart (GR) abilities.
12.2(28)SB	This command was implemented on the Cisco 10000 series routers. Example output was changed for the Cisco 10000 series router, and two fields (SSO Descriptor and SSM segment/switch IDs) were removed from the output, because they are not supported.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRB	This command was updated to include forwarding equivalence class (FEC) 129 signaling information for pseudowires that are configured through VPLS Autodiscovery, and to support provisioning Any Transport over MPLS (AToM) static pseudowires.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SRC	This command was updated to display the number of MAC address withdrawal messages sent and received as part of the H-VPLS N-PE Redundancy for QinQ and MPLS Access feature. This command was updated to display pseudowire status between peer routers that have been configured for the MPLS Pseudowire Status Signaling feature.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If you do not specify any keywords or arguments, the command displays a summary of all the VCs.

Examples

The output of the commands varies, depending on the type of Layer 2 packets being transported over the AToM VCs.

The following example shows information about the interfaces and VCs that have been configured to transport various Layer 2 packets on the router:

```
Router# show mpls l2transport vc

Local intf     Local circuit      Dest address    VC ID      Status
-------------  ------------------ --------------- ---------- ----------
AT4/0          ATM AAL5 0/100     10.0.0.1        100        UP
AT4/0          ATM AAL5 0/200     10.0.0.1        200        UP
AT4/0.300      ATM AAL5 0/300     10.0.0.1        300        UP
```

Table 1-41 describes the significant fields shown in the display.

Table 1-41 show mpls l2transport vc Field Descriptions

Field	Description
Local intf	The interface on the local router that has been enabled to transport Layer 2 packets.
Local circuit	The type and number (if applicable) of the local circuit. The output shown in this column varies, depending on the transport type: • For ATM cell relay and AAL5, the output shows the VPI/VCI of the PVC. • For Ethernet VLANs, the output shows the VLAN number.
Dest address	The IP address of the remote router's interface that is the other end of the VC.
VC ID	The VC identifier assigned to one of the interfaces on the router.
Status	The status of the VC. The status can be one of the following conditions: • UP—The VC is in a state where it can carry traffic between the two VC endpoints. A VC is up when both imposition and disposition interfaces are programmed. – The disposition interface is programmed if the VC has been configured and the client interface is up. – The imposition interface is programmed if the disposition interface is programmed and you have a remote VC label and an Interior Gateway Protocol (IGP) label. The IGP label can be implicit null in a back-to-back configuration. An IGP label means there is a Label Switched Path (LSP) to the peer. • DOWN—The VC is not ready to carry traffic between the two VC endpoints. Use the **detail** keyword to determine the reason that the VC is down. • ADMIN DOWN—The VC has been disabled by a user. • RECOVERING—The VC is recovering from a stateful switchover.

The following example shows information about the NSF/SSO and graceful restart capability. The SSO portion indicates when checkpointing data has either been sent (on active) or received (on standby). When SSO data has not been successfully sent or has been released, the SSO information is not shown.

```
Router# show mpls l2transport vc detail

Local interface: Fa0/1.1 down, line protocol down, Eth VLAN 2 up
  Destination address: 10.55.55.2, VC ID: 1002, VC status: down
    Output interface: Fa0/0, imposed label stack {16}
    Preferred path: not configured
    Default path: active
    Tunnel label: imp-null, next hop point2point
  Create time: 02:03:29, last status change time: 02:03:26
  Signaling protocol: LDP, peer 10.55.55.2:0 down
    MPLS VC labels: local 16, remote unassigned
    Group ID: local 0, remote unknown
    MTU: local 1500, remote unknown
    Remote interface description:
  Sequencing: receive disabled, send disabled
  SSO Descriptor: 10.55.55.2/1002, local label: 16
    SSM segment/switch IDs: 12290/8193, PWID: 8193
  VC statistics:
```

```
packet totals: receive 0, send 0
byte totals:   receive 0, send 0
packet drops:  receive 0, send 0
```

Table 1-42 describes the significant fields shown in the display.

Table 1-42 show mpls l2transport vc Field Descriptions

Field	Description
Local interface	Interface on the local router that has been enabled to send and receive Layer 2 packets. The interface varies, depending on the transport type. The output also shows the status of the interface.
line protocol	Status of the line protocol on the edge-facing interface.
Destination address	IP address of the remote router specified for this VC. Specify the destination IP address as part of the **mpls l2transport route** command.
VC ID	VC identifier assigned to the interface on the router.
VC status	Status of the VC, which is one of the following conditions: UP—The VC is in a state where it can carry traffic between the two VC endpoints. A VC is up when both imposition and disposition interfaces are programmed. • The disposition interface is programmed if the VC has been configured and the client interface is up. • The imposition interface is programmed if the disposition interface is programmed and a remote VC label and an IGP label exist. The IGP label can be an implicit null in a back-to-back configuration. (An IGP label means there is an LSP to the peer.) DOWN—The VC is not ready to carry traffic between the two VC endpoints. ADMIN DOWN—The VC has been disabled by a user.
Output interface	Interface on the remote router that has been enabled to transmit and receive Layer 2 packets.
imposed label stack	Summary of the MPLS label stack used to direct the VC to the PE router.
Preferred path	Path that was assigned to the VC and the status of that path. The path can be an MPLS traffic engineering tunnel or an IP address or hostname of a PE router.
Default path	Status of the default path, which can be disabled or active. By default, if the preferred path fails, the router uses the default path. However, you can disable the router from using the default path when the preferred path fails by specifying the **disable-fallback** keyword with the **preferred-path** command.
Create time	Time when the VC was provisioned.
last status change time	Last time the VC state changed.
Signaling protocol	Type of protocol used to send the MPLS labels. The output also shows the status of the peer router.

Table 1-42 show mpls l2transport vc Field Descriptions (continued)

Field	Description
MPLS VC labels	Local VC label is a disposition label, which determines the egress interface of an arriving packet from the MPLS backbone. The remote VC label is a disposition VC label of the remote peer router.
Group ID	Local group ID is used to group VCs locally. The remote group ID is used by the peer to group several VCs.
MTU	Maximum transmission unit specified for the local and remote interfaces.
Remote interface description	Interface on the remote router that has been enabled to transmit and receive Layer 2 packets.
Sequencing	Indicates whether sequencing of out-of-order packets is enabled or disabled.
Tunnel label	An IGP label used to route the packet over the MPLS backbone to the destination router with the egress interface. The first part of the output displays the type of label. The second part of the output displays the route information. The tunnel label information can display any of the following states: • imp-null—The provider (P) router is absent and the tunnel label is not to be used. Alternatively, imp-null can signify traffic engineering tunnels between the PE routers. • unassigned—The label has not been assigned. • no route—The label is not in the routing table. • no adjacency—The adjacency for the next hop is missing. • not ready, no route—An IP route for the peer does not exist in the routing table. • not ready, not a host table—The route in the routing table for the remote peer router is not a host route. • not ready, Cisco Express Forwarding disabled—Cisco Express Forwarding is disabled. • not ready, label forwarding information base (LFIB) disabled—The MPLS switching subsystem is disabled. • not ready, LFIB entry present—The tunnel label exists in the LFIB, but the VC is down.
SSO Descriptor	Identifies the VC for which the information was checkpointed.
local label	The value of the local label that was checkpointed (that is, sent on the active Route Processor [RP], and received on the standby RP).
SSM segment/switch IDs	The IDs used to refer to the control plane and data plane contexts for this VC. This data is not for customer use but for Cisco personnel for troubleshooting purposes. When the source specific multicast (SSM) IDs are followed by the word “used,” the checkpointed data has been successfully sent and not released.
PWID	The PW ID used in the data plane to correlate the switching context for the segment mentioned with the MPLS switching context. This data is not for customer use but for Cisco personnel for troubleshooting purposes.
packet totals	Number of packets sent and received. Received packets are those AToM packets received from the MPLS core. Sent packets are those AToM packets sent to the MPLS core. This number does not include dropped packets.

Table 1-42 show mpls l2transport vc Field Descriptions (continued)

Field	Description
byte totals	Number of bytes sent and received from the core-facing interface, including the payload, control word if present, and AToM VC label.
packet drops	Number of dropped packets.

Related Commands

Command	Description
show mpls l2transport summary	Displays summary information about VCs that have been enabled to route AToM Layer 2 packets on a router.

show network-clocks

To display information about the network clocks configured on the router, use the **show network-clocks** command. The command shows the priority and state of all configured clocks and the currently selected clock.

show network-clocks

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.2(33)SRD1	This command was modified to display BITS clock information for the 7600-ES+ITU-2TG and the 7600-ES+ITU-4TG.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was enhanced to show information for REP.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the **show network-clocks** command:

```
Router# show network-clocks

Network Clock Configuration
Priority  Source            Status   Type          Selected
------------------------------------------------------------
 01       Packet Timing     NOT OK   Packet Timing N
 02       E1 0/15           OK       E1/T1         Y
 03       BITS              NOT OK   BITS          N
 04       E1 0/14           OK       E1/T1         N
------------------------------------------------------------

 Current Clock State LOCK
 clock input Stratum level: 3

 mode : Revertive

 hold-timeout 900 sec
------------------------------------------------------------
```

Related Commands

Command	Description
set network-clocks force-reselect	This command causes the router to reselect a network clock.

show network-clocks synchronization

To display a the synchronization status of a network clock, use the **show network-clock synchronization** command in privileged EXEC mode.

show network-clock synchronization [[[interface *interface-name slot/card/port* **| external** *slot/card/port* **| controller** *slot/card/port*] **| global | top** *slot/card/port/session*] **detail]**

Related Commands

interface	Specifies the interface connected to the clock input.
interface-name	The name of the interface connected to the clock input.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
interface-name	The name of the interface connected to the clock input.
external	Specifies an external interface.
slot	The slot where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
controller	Specifies the controller of the network clock source.
slot	The slot where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
global	Displays global parameters.
top	Specifies the timing over packet (ToP) interface.
slot	The slot of Router/Switch where the clock source is present.
card	The bay in which card is inserted.
port	The port of the card.
session	The session on the TOP interface. **Note** If the session ID is not required to identify the clock source, enter **0**. **Note** The IEEE 1588 standard permits two clock sources per port; use the session keyword to distinguish between two clocks on one port.
detail	Provides additional detail about a network clock synchronization status.

Command Modes

Privileged EXEC

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Examples

The following example shows how to display the synchronization status for a network clock.

```
Router# show network-clock synchronization
Symbols:     En - Enable, Dis - Disable, Adis - Admin Disable
               NA - Not Applicable
               *  - Synchronization source selected
               #  - Synchronization source force selected
               &  - Synchronization source manually switched

Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Disable
SSM Option : 1
T0  : Ethernet0/1
Hold-off (global) : 200 ms
Wait-to-restore (global) : 5 sec
Revertive : Yes

Nominated Interfaces

 Interface            SigType  Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
 Internal             NA       NA/Dis       251   NA     Dis      Dis
 Et0/0                NA       Async/Dis    4     NA     Dis      Dis
*Et0/1                NA       Async/Dis    3     NA     Dis      Dis
 Et0/2                NA       Async/Dis    1     NA     Dis      Dis

T4 Out

 External Interface   SigType  Input  Prio  Squelch  AIS
external 0/0/0       10M      Et0/1  1     FALSE    FALSE
external 0/0/0       E1         Et0/1  1     FALSE    FALSE
```

show platform hardware

To display the status of hardware devices on the Cisco MWR 2941, use the **show platform hardware** command. The command displays information about hardware devices on the Cisco MWR 2941 for troubleshooting and debugging purposes.

show platform hardware {**adrian** | **bits** | **cpld** | **cpu** | **ethernet** | **fio** | **hwic** | **rtm** | **stratum** | **ufe** | **winpath**}

Syntax Description

adrian	Displays information about the adrian hardware.
bits	Displays information about the BITS hardware.
cpld	Displays information about the CPLD hardware.
cpu	Displays information about the CPU.
ethernet	Displays information about the ethernet interfaces on the Cisco MWR 2941.
fio	Displays information about the FIO fpga hardware.
hwic	Displays information about the HWICs installed on the Cisco MWR 2941.
rtm	Displays information about the RTM Module (ASM-M2900-TOP daughter card).
stratum	Displays information about the stratum hardware.
ufe	Displays information about the UFE hardware.
winpath	Displays information about the Winpath hardware.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(19)MR2	This command was incorporated.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR and the **iphc** sub-keyword option was added to the **winpath** keyword option to display IPHC information about the Winpath hardware.

Usage Guidelines

Use the **show platform hardware** command to display information about hardware devices on the Cisco MWR 2941 for troubleshooting and debugging purposes.

To display IPHC information for the Winpath device, use the **show platform hardware** command and specify the **winpath iphc** commands.

For a complete list of **show platform hardware** command keyword options and sub-keyword options, use the **show platform hardware ?** command.

Examples

The following is the command output for the **show platform hardware** command with the **winpath iphc** keyword options specified:

```
Router#show platform hardware winpath iphc
Distributed IPHC is enabled

System Info:
IPHC Contexts:
  Compression 0x94000000, Decompression 0x94000001, used TRUE
IPHC Punt Host FlowAgg:

  iw_ipv4_comp_flowagg      = 0x44600004
         Object            Flow Agg    Packets     Bytes      Denied    Dropped
   --------------------  ----------  ---------- ---------- ---------- ----------
   IPv4 Compression Pun  0x44600004  1021048    88479276   0          36349

Compression info for Multilink1
  Entry Flow Agg:

   flow_agg: 0x4470006B
    forward_packet  = 1162620621
    forwarded_bytes = 3261768674
    denied_packets  = 0
    dropped_packets = 0
Multilink1 IPHC CompGroup: 0x88000008
Max Comp CIDS (16), used (0)

---------- Compressor per cid stats ------

Decompression info for Multilink1
IPHC Decomp FlowAgg:
  flow_agg: 0x457000F4
   forward_packet  = 0
   forwarded_bytes = 0
   denied_packets  = 0
   dropped_packets = 0
Multilink1 IPHC DecompGroup: 0x90000008
ip_version_errors                 = 0
  ip_full_header_length_errors      = 0
  ip_only_mode_lcid_errors          = 0
  cid_errors                        = 0
  ipv4_checksum_errors              = 0
  ipv4_fragment_packets             = 0
  ipv4_options_packets              = 0
  ipv4_fragment_and_options_packets = 0

---------- Decompressor per cid stats ------
   full_header_classification_errors = 0
   out_of_synchronization_errors     = 0
  generation_errors                = 0
   iw_gap_size_errors                = 0
   compressed_length_errors          = 0
   full_headers                      = 0
   compressed_headers                = 0
   full_header_classification_errors = 0
   out_of_synchronization_errors     = 0
    generation_errors                = 0
   iw_gap_size_errors                = 0
   compressed_length_errors          = 0
   full_headers                      = 0
   compressed_headers                = 0
full_header_classification_errors = 0
   out_of_synchronization_errors     = 0
```

```
    generation_errors                = 0
   iw_gap_size_errors                = 0
   compressed_length_errors          = 0
   full_headers                      = 0
   compressed_headers                = 0
   full_header_classification_errors = 0
   out_of_synchronization_errors     = 0
    generation_errors                = 0
   iw_gap_size_errors                = 0
   compressed_length_errors          = 0
full_headers                       = 0
   compressed_headers                = 0
   full_header_classification_errors = 0
   out_of_synchronization_errors     = 0
    generation_errors                = 0
   iw_gap_size_errors                = 0
   compressed_length_errors          = 0
   full_headers                      = 0
   compressed_headers                = 0
```

Related Commands

Command	Description
show controller	Displays the status of system controllers.

show policy-map

To display the configuration of all classes for a specified service policy map or of all classes for all existing policy maps, use the **show policy-map** command in user EXEC or privileged EXEC mode.

show policy-map [*policy-map*]

Syntax Description

policy-map	(Optional) Name of the service policy map whose complete configuration is to be displayed. The name can be a maximum of 40 characters.

Command Default

All existing policy map configurations are displayed.

Command Modes

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was incorporated into Cisco IOS Release 12.0(5)XE.
12.0(7)S	This command was incorporated into Cisco IOS Release 12.0(7)S.
12.1(1)E	This command was incorporated into Cisco IOS Release 12.1(1)E.
12.2(4)T	This command was modified for two-rate traffic policing to display burst parameters and associated actions.
12.2(8)T	The command was modified for the Policer Enhancement—Multiple Actions feature and the Weighted Random Early Detection (WRED)—Explicit Congestion Notification (ECN) feature.
12.2(13)T	The following modifications were made: • The output was modified for the Percentage-Based Policing and Shaping feature. • This command was modified as part of the Modular QoS CLI (MQC) Unconditional Packet Discard feature. Traffic classes can now be configured to discard packets belonging to a specified class. • This command was modified for the Enhanced Packet Marking feature. A mapping table (table map) can now be used to convert and propagate packet-marking values.
12.2(15)T	This command was modified to support display of Frame Relay voice-adaptive traffic-shaping information.
12.0(28)S	The output of this command was modified for the QoS: Percentage-Based Policing feature to display the committed (conform) burst (bc) and excess (peak) burst (be) sizes in milliseconds (ms).
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	This command was implemented on the Supervisor Engine 2 and integrated into Cisco IOS Release 12.2(17d)SXB.

Release	Modification
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB, and the command was modified to display information about Layer 2 Tunnel Protocol Version 3 (L2TPv3) tunnel marking.
12.2(31)SB2	This command was enhanced to display bandwidth-remaining ratios configured on traffic classes and ATM overhead accounting, and was implemented on the Cisco 10000 series router for the PRE3.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRC	Support for the Cisco 7600 series router was added.
12.4(15)T2	This command was modified to display information about Generic Routing Encapsulation (GRE) tunnel marking. **Note** For this release, GRE-tunnel marking is supported on the Cisco MGX Route Processor Module (RPM-XF) platform *only*.
12.2(33)SB	This command was modified to display information about GRE-tunnel marking, and support for the Cisco 7300 series router was added. This command's output was modified on the Cisco 10000 series router for the PRE3 and PRE4.
Cisco IOS XE 2.1	This command was integrated into Cisco IOS XE Release 2.1 and was implemented on the Cisco ASR 1000 series router.
12.4(20)T	Support was added for hierarchical queueing framework (HQF) using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support Weighted Random Early Detection (WRED).

Usage Guidelines

The **show policy-map** command displays the configuration of a policy map created using the **policy-map** command. You can use the **show policy-map** command to display all class configurations comprising any existing service policy map, whether or not that policy map has been attached to an interface. The command displays:

- ECN marking information only if ECN is enabled on the interface.
- Bandwidth-remaining ratio configuration and statistical information, if configured and used to determine the amount of unused (excess) bandwidth to allocate to a class queue during periods of congestion.

Examples

This section provides sample output from typical **show policy-map** commands. Depending upon the interface or platform in use and the options enabled (for example, Weighted Fair Queueing [WFQ]), the output you see may vary slightly from the ones shown below.

- Traffic Policing: Example, page -583
- Two-Rate Traffic Policing: Example, page -583
- Multiple Traffic Policing Actions: Example, page -584
- Explicit Congestion Notification: Example, page -585
- Percentage-Based Policing and Shaping: Example, page -586

- Bandwidth-Remaining Ratio: Example, page -587
- Tunnel Marking: Example, page -588

Traffic Policing: Example

The following is sample output from the **show policy-map** command. This sample output displays the contents of a policy map called "policy1." In policy 1, traffic policing on the basis of a committed information rate (CIR) of 20 percent has been configured, and the bc and be have been specified in milliseconds. As part of the traffic policing configuration, optional conform, exceed, and violate actions have been specified.

```
Router# show policy-map policy1

  Policy Map policy1
    Class class1
     police cir percent 20 bc 300 ms pir percent 40 be 400 ms
       conform-action transmit
       exceed-action drop
       violate-action drop
```

Table 1-43 describes the significant fields shown in the display.

Table 1-43 show policy-map Field Descriptions—Configured for Traffic Policing

Field	Description
Policy Map	Name of policy map displayed.
Class	Name of the class configured in the policy map displayed.
police	Indicates that traffic policing on the basis of specified percentage of bandwidth has been enabled. The committed burst (Bc) and excess burst (Be) sizes have been specified in milliseconds (ms), and optional conform, exceed, and violate actions have been specified.

Two-Rate Traffic Policing: Example

The following is sample output from the **show policy-map** command when two-rate traffic policing has been configured. As shown below, two-rate traffic policing has been configured for a class called "police." In turn, the class called police has been configured in a policy map called "policy1." Two-rate traffic policing has been configured to limit traffic to an average committed rate of 500 kbps and a peak rate of 1 Mbps.

```
Router(config)# class-map police
Router(config-cmap)# match access-group 101
Router(config-cmap)# policy-map policy1
Router(config-pmap)# class police
Router(config-pmap-c)# police cir 500000 bc 10000 pir 1000000 be 10000 conform-action
transmit exceed-action set-prec-transmit 2 violate-action drop
Router(config-pmap-c)# interface serial3/0
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface serial3/0
Router(config-if)# service-policy output policy1
Router(config-if)# end

The following sample output shows the contents of the policy map called "policy1":

Router# show policy-map policy1

 Policy Map policy1
```

```
Class police
 police cir 500000 conform-burst 10000 pir 1000000 peak-burst 10000 conform-action
 transmit exceed-action set-prec-transmit 2 violate-action drop
```

Traffic marked as conforming to the average committed rate (500 kbps) will be sent as is. Traffic marked as exceeding 500 kbps, but not exceeding 1 Mbps, will be marked with IP Precedence 2 and then sent. All traffic exceeding 1 Mbps will be dropped. The burst parameters are set to 10000 bytes.

Table 1-44 describes the significant fields shown in the display.

Table 1-44 show policy-map Field Descriptions—Configured for Two-Rate Traffic Policing

Field	Description
police	Indicates that the **police** command has been configured to enable traffic policing. Also, displays the specified CIR, conform burst size (bc), peak information rate (PIR), and peak burst (BE) size used for marking packets.
conform-action	Displays the action to be taken on packets conforming to a specified rate.
exceed-action	Displays the action to be taken on packets exceeding a specified rate.
violate-action	Displays the action to be taken on packets violating a specified rate.

Multiple Traffic Policing Actions: Example

The following is sample output from the **show policy-map** command when the Policer Enhancement—Multiple Actions feature has been configured. The following sample output from the **show policy-map** command displays the configuration for a service policy called "police." In this service policy, traffic policing has been configured to allow multiple actions for packets marked as conforming to, exceeding, or violating the CIR or the PIR shown in the example.

```
Router# show policy-map police

  Policy Map police
    Class class-default
     police cir 1000000 bc 31250 pir 2000000 be 31250
       conform-action transmit
       exceed-action set-prec-transmit 4
       exceed-action set-frde-transmit

       violate-action set-prec-transmit 2
       violate-action set-frde-transmit
```

Packets conforming to the specified CIR (1000000 bps) are marked as conforming packets. These are transmitted unaltered.

Packets exceeding the specified CIR (but not the specified PIR, 2000000 bps) are marked as exceeding packets. For these packets, the IP Precedence level is set to 4, the discard eligibility (DE) bit is set to 1, and the packet is transmitted.

Packets exceeding the specified PIR are marked as violating packets. For these packets, the IP Precedence level is set to 2, the DE bit is set to 1, and the packet is transmitted.

Note Actions are specified by using the *action* argument of the **police** command. For more information about the available actions, see the **police** command reference page.

Table 1-45 describes the significant fields shown in the display.

Table 1-45 show policy-map Field Descriptions—Configured for Multiple Traffic Policing Actions

Field	Description
police	Indicates that the **police** command has been configured to enable traffic policing. Also, displays the specified CIR, BC, PIR, and BE used for marking packets.
conform-action	Displays the one or more actions to be taken on packets conforming to a specified rate.
exceed-action	Displays the one or more actions to be taken on packets exceeding a specified rate.
violate-action	Displays the one or more actions to be taken on packets violating a specified rate.

Explicit Congestion Notification: Example

The following is sample output from the **show policy-map** command when the WRED—Explicit Congestion Notification (ECN) feature has been configured. The words "explicit congestion notification" (along with the ECN marking information) included in the output indicate that ECN has been enabled.

```
Router# show policy-map

   Policy Map pol1
     Class class-default
       Weighted Fair Queueing
             Bandwidth 70 (%)
             exponential weight 9
             explicit congestion notification
             class    min-threshold    max-threshold    mark-probability
             ------------------------------------------------------------
             ------------------------------------------------------------

             0        -                -                1/10
             1        -                -                1/10
             2        -                -                1/10
             3        -                -                1/10
             4        -                -                1/10
             5        -                -                1/10
             6        -                -                1/10
             7        -                -                1/10
             rsvp     -                -                1/10
```

Table 1-46 describes the significant fields shown in the display.

Table 1-46 show policy-map Field Descriptions—Configured for ECN

Field	Description
explicit congestion notification	Indication that Explicit Congestion Notification is enabled.
class	IP precedence value.
min-threshold	Minimum threshold. Minimum WRED threshold in number of packets.
max-threshold	Maximum threshold. Maximum WRED threshold in number of packets.
mark-probability	Fraction of packets dropped when the average queue depth is at the maximum threshold.

Percentage-Based Policing and Shaping: Example

The following example displays the contents of two service policy maps—one called "policy1" and one called "policy2." In policy1, traffic policing based on a CIR of 50 percent has been configured. In policy 2, traffic shaping based on an average rate of 35 percent has been configured.

```
Router# show policy-map policy1

Policy Map policy1
 class class1
    police cir percent 50

Router# show policy-map policy2

Policy Map policy2
 class class2
    shape average percent 35
```

The following example displays the contents of the service policy map called "po1":

```
Router# show policy-map po1

Policy Map po1
 Weighted Fair Queueing
    Class class1
Bandwidth 937 (kbps) Max thresh 64 (packets)
    Class class2
        Bandwidth 937 (kbps)  Max thresh 64 (packets)
  Class class3
     Bandwidth 937 (kbps)  Max thresh 64 (packets)
  Class class4
     Bandwidth 937 (kbps)  Max thresh 64 (packets)
```

The following example displays the contents of all policy maps on the router:

```
Router# show policy-map

Policy Map poH1
 Weighted Fair Queueing
    Class class1
       Bandwidth 937 (kbps) Max thresh 64 (packets)
    Class class2
        Bandwidth 937 (kbps)  Max thresh 64 (packets)
```

```
    Class class3
        Bandwidth 937 (kbps)  Max thresh 64 (packets)
    Class class4
        Bandwidth 937 (kbps)  Max thresh 64 (packets)
Policy Map policy2
 Weighted Fair Queueing
    Class class1
       Bandwidth 300 (kbps) Max thresh 64 (packets)
    Class class2
        Bandwidth 300  (kbps)  Max thresh 64 (packets)
    Class class3
        Bandwidth 300 (kbps)  Max thresh 64 (packets)
    Class class4
        Bandwidth 300 (kbps)  Max thresh 64 (packets)
```

Table 1-47 describes the significant fields shown in the display.

Table 1-47 show policy-map Field Descriptions—Configured for Percentage-Based Policing and Shaping

Field	Description
Policy Map	Name of policy map displayed.
Weighted Fair Queueing	Indicates that weighted fair queueing (WFQ) has been enabled.
Class	Name of class configured in policy map displayed.
Bandwidth	Bandwidth, in kbps, configured for this class.
Max threshold	Maximum threshold. Maximum WRED threshold in number of packets.

Bandwidth-Remaining Ratio: Example

The following sample output for the **show policy-map** command indicates that the class-default class of the policy map named vlan10_policy has a bandwidth-remaining ratio of 10. When congestion occurs, the scheduler allocates class-default traffic 10 times the unused bandwidth allocated in relation to other subinterfaces.

```
Router# show policy-map vlan10_policy

  Policy Map vlan10_policy
    Class class-default
      Average Rate Traffic Shaping
      cir 1000000 (bps)
      bandwidth remaining ratio 10
      service-policy child_policy
```

Table 1-48 describes the fields shown in the display.

Table 1-48 show policy-map Field Descriptions—Configured for Bandwidth-Remaining Ratio

Field	Description
Policy Map	Name of the policy map being displayed.
Class	Name of the class in the policy map being displayed.
Average Rate Traffic Shaping	Indicates that Average Rate Traffic Shaping is configured.
cir	Committed information rate (CIR) used to shape traffic.
bandwidth remaining ratio	Indicates the ratio used to allocate excess bandwidth.

Tunnel Marking: Example

In this sample output of the **show policy-map** command, the character string "ip precedence tunnel 4" indicates that tunnel marking (either L2TPv3 or GRE) has been configured to set the IP precedence value to 4 in the header of a tunneled packet.

```
Router# show policy-map

Policy Map TUNNEL_MARKING
    Class MATCH_FRDE
      set ip precedence tunnel 4
```

Table 1-49 describes the fields shown in the display.

Table 1-49 show policy-map Field Descriptions—Configured for Tunnel Marking

Field	Description
Policy Map	Name of the policy map being displayed.
Class	Name of the class in the policy map being displayed.
set ip precedence tunnel	Indicates that tunnel marking has been configured.

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map, and enables ATM overhead accounting.
class (policy map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
class–map	Creates a class map to be used for matching packets to a specified class.
drop	Configures a traffic class to discard packets belonging to a specific class.
police	Configures traffic policing.
police (two rates)	Configures traffic policing using two rates, the CIR and the PIR.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
shape	Shapes traffic to the indicated bit rate according to the algorithm specified, and enables ATM overhead accounting.
show policy-map class	Displays the configuration for the specified class of the specified policy map.
show policy-map interface	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.
show running-config	Displays the current configuration of the router. If configured, the command output includes information about ATM overhead accounting.
show table-map	Displays the configuration of a specified table map or of all table maps.
table-map (value mapping)	Creates and configures a mapping table for mapping and converting one packet-marking value to another.

show policy-map interface

To display the statistics and the configurations of the input and output policies that are attached to an interface, use the **show policy-map interface** command in user EXEC or privileged EXEC mode.

show policy-map interface [**type access-control**] *type number* [**vc** [*vpi*/] *vci*] [**dlci** *dlci*] [**input** | **output**]

Syntax Description

type	Type of interface or subinterface whose policy configuration is to be displayed.
number	Port, connector, or interface card number.
vc	(Optional) For ATM interfaces only, shows the policy configuration for a specified PVC.
vpi/	(Optional) ATM network virtual path identifier (VPI) for this permanent virtual circuit (PVC). On the Cisco 7200 and 7500 series routers, this value ranges from 0 to 255. The *vpi* and *vci* arguments cannot both be set to 0; if one is 0, the other cannot be 0. The absence of both the forward slash (/) and a *vpi* value defaults the *vpi* value to 0. If this value is omitted, information for all virtual circuits (VCs) on the specified ATM interface or subinterface is displayed.
vci	(Optional) ATM network virtual channel identifier (VCI) for this PVC. This value ranges from 0 to 1 less than the maximum value set for this interface by the **atm vc-per-vp** command. Typically, the lower values 0 to 31 are reserved for specific traffic (F4 Operation, Administration, and Maintenance [OAM], switched virtual circuit [SVC] signaling, Integrated Local Management Interface [ILMI], and so on) and should not be used. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has local significance only. The *vpi* and *vci* arguments cannot both be set to 0; if one is 0, the other cannot be 0.
dlci	(Optional) Indicates a specific PVC for which policy configuration will be displayed.
dlci	(Optional) A specific data-link connection identifier (DLCI) number used on the interface. Policy configuration for the corresponding PVC will be displayed when a DLCI is specified.
input	(Optional) Indicates that the statistics for the attached input policy will be displayed.
output	(Optional) Indicates that the statistics for the attached output policy will be displayed.
slot	(ATM shared port adapter only) Chassis slot number. See the appropriate hardware manual for slot information. For SIPs, see the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for SIPs and SPAs” topic in the platform-specific SPA software configuration guide.

/subslot	(ATM shared port adapter only) Secondary slot number on an SPA interface processor (SIP) where a SPA is installed. See the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on an SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/port	(ATM shared port adapter only) Port or interface number. See the appropriate hardware manual for port information. For SPAs, see the corresponding "Specifying the Interface Address" topics in the platform-specific SPA software configuration guide.
.subinterface	(ATM shared port adapter only—Optional) Subinterface number. The number that precedes the period must match the number to which this subinterface belongs. The range is 1 to 4,294,967,293.
interface-type	(Optional) Interface type; possible valid values are **ethernet**, **fastethernet**, **gigabitethernet**, **tengigabitethernet**, **pos**, **atm**, and **ge-wan**.
interface-number	(Optional) Module and port number; see the "Usage Guidelines" section for valid values.
null 0	(Optional) Specifies the null interface; the only valid value is 0.
vlan *vlan-id*	(Optional) Specifies the VLAN ID; valid values are from 1 to 4094.
detailed	(Optional) Displays additional statistics.
class *class-name*	(Optional) Displays the QoS policy actions for the specified class.
port-channel *channel-number*	(Optional) Displays the EtherChannel port-channel interface.

Command Default

This command displays the packet statistics of all classes that are configured for all service policies on the specified interface or subinterface or on a specific permanent virtual circuit (PVC) on the interface.

The absence of both the forward slash (**/**) and a *vpi* value defaults the *vpi* value to 0. If this value is omitted, information for all virtual circuits (VCs) on the specified ATM interface or subinterface is displayed.

Command Modes

Privileged EXEC (#)

ATM Shared Port Adapter

User EXEC (>)
Privileged EXEC (#)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.0(7)S	This command was integrated into Cisco IOS Release 12.0(7)S.
12.0(28)S	This command was modified for the QoS: Percentage-Based Policing feature to include milliseconds when calculating the committed (conform) burst (bc) and excess (peak) burst (be) sizes.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.

Release	Modification
12.1(2)T	This command was modified to display information about the policy for all Frame Relay PVCs on the interface or, if a DLCI is specified, the policy for that specific PVC. This command was also modified to display the total number of packets marked by the quality of service (QoS) set action.
12.1(3)T	This command was modified to display per-class accounting statistics.
12.2(4)T	This command was modified for two-rate traffic policing and can display burst parameters and associated actions.
12.2(8)T	The command was modified for the Policer Enhancement—Multiple Actions feature and the WRED—Explicit Congestion Notification (ECN) feature. For the Policer Enhancement—Multiple Actions feature, the command was modified to display the multiple actions configured for packets conforming to, exceeding, or violating a specific rate. For the WRED—Explicit Congestion Notification (ECN) feature, the command displays ECN marking information.
12.2(13)T	The following modifications were made: • This command was modified for the Percentage-Based Policing and Shaping feature. • This command was modified for the Class-Based RTP and TCP Header Compression feature. • This command was modified as part of the Modular QoS CLI (MQC) Unconditional Packet Discard feature. Traffic classes in policy maps can now be configured to discard packets belonging to a specified class. • This command was modified to display the Frame Relay DLCI number as a criterion for matching traffic inside a class map. • This command was modified to display Layer 3 packet length as a criterion for matching traffic inside a class map. • This command was modified for the Enhanced Packet Marking feature. A mapping table (table map) can now be used to convert and propagate packet-marking values.
12.2(14)SX	Support for this command was introduced on Cisco 7600 series routers.
12.2(15)T	This command was modified to display Frame Relay voice-adaptive traffic-shaping information.
12.2(17d)SXB	This command was implemented on the Supervisor Engine 2 and integrated into Cisco IOS Release 12.2(17d)SXB.
12.3(14)T	This command was modified to display bandwidth estimation parameters.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE. This command was modified to display aggregate WRED statistics for the ATM shared port adapter. Note that changes were made to the syntax, defaults, and command modes. These changes are labelled “ATM Shared Port Adapter.”
12.4(4)T	The **type access-control** keywords were added to support flexible packet matching.

Release	Modification
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB, and the following modifications were made: • This command was modified to display either legacy (undistributed processing) QoS or hierarchical queueing framework (HQF) parameters on Frame Relay interfaces or PVCs. • This command was modified to display information about Layer 2 Tunnel Protocol Version 3 (L2TPv3) tunnel marking.
12.2(31)SB2	The following modifications were made: • This command was enhanced to display statistical information for each level of priority service configured and information about bandwidth-remaining ratios, and this command was implemented on the Cisco 10000 series router for the PRE3. • This command was modified to display statistics for matching packets on the basis of VLAN identification numbers. As of Cisco IOS Release 12.2(31)SB2, matching packets on the basis of VLAN identification numbers is supported on Cisco 10000 series routers only.
12.2(33)SRC	This command was integrated into Cisco IOS Release 12.2(33)SRC.
12.4(15)T2	This command was modified to display information about Generic Routing Encapsulation (GRE) tunnel marking. **Note** As of this release, GRE-tunnel marking is supported on the Cisco MGX Route Processor Module (RPM-XF) platform *only*.
12.2(33)SB	This command was modified to display information about GRE-tunnel marking, and support for the Cisco 7300 series router was added.
Cisco IOS XE 2.1	This command was integrated into Cisco IOS XE Release 2.1 and was implemented on the Cisco ASR 1000 series router.
12.4(20)T	Support was added for hierarchical queueing framework (HQF) using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).
12.2(33)SXI	This command was implemented on the Catalyst 6500 series switch and modified to display the strict level in the priority feature and the counts per level.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support Weighted Random Early Detection (WRED).

Usage Guidelines

The **show policy-map interface** command displays the packet statistics for classes on the specified interface or the specified PVC only if a service policy has been attached to the interface or the PVC.

The counters displayed after the **show policy-map interface** command is entered are updated only if congestion is present on the interface.

Examples

This section provides sample output from typical **show policy-map interface** commands. Depending upon the interface or platform in use and the options enabled, the output you see may vary slightly from the ones shown below.

- Traffic Shaping on Serial Interface: Example, page -593
- Two-Rate Traffic Policing: Example, page -596
- Multiple Traffic Policing Actions: Example, page -597
- Percentage-Based Policing and Shaping: Example, page -598
- Traffic Shaping: Example, page -600
- Traffic Policing: Example, page -601

Traffic Shaping on Serial Interface: Example

The following sample output from the **show policy-map interface** command displays the statistics for the serial 3/2 interface, to which a service policy called p1 (configured as shown below) is attached. Traffic shaping has been enabled on this interface. See Table 1-50 for an explanation of the significant fields that commonly appear in the command output.

```
policy-map p1
 class c1
  shape average 320000

Router# show policy-map interface serial3/2 output

 Serial3/2

  Service-policy output: p1

    Class-map: c1 (match-all)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match: ip precedence 0
      Traffic Shaping
        Target     Byte   Sustain   Excess    Interval  Increment Adapt
        Rate       Limit  bits/int  bits/int  (ms)      (bytes)   Active
        320000     2000   8000      8000      25        1000      -

        Queue      Packets   Bytes     Packets   Bytes     Shaping
        Depth                          Delayed   Delayed   Active
        0          0         0         0         0         no
```

```
Class-map: class-default (match-any)
  0 packets, 0 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: any
```

Table 1-50 describes significant fields commonly shown in the displays. The fields in the table are grouped according to the relevant QoS feature.

Table 1-50 show policy-map interface Field Descriptions[1]

Field	Description
Fields Associated with Classes or Service Policies	
Service-policy output	Name of the output service policy applied to the specified interface or VC.
Class-map	Class of traffic being displayed. Output is displayed for each configured class in the policy. The choice for implementing class matches (for example, match-all or match-any) can also appear next to the traffic class.
packets and bytes	Number of packets (also shown in bytes) identified as belonging to the class of traffic being displayed.
offered rate	Rate, in kbps, of packets coming in to the class. **Note** If the packets are compressed over an outgoing interface, the improved packet rate achieved by packet compression is not reflected in the offered rate. Also, if the packets are classified *before* they enter a combination of tunnels (for example, a generic routing encapsulation (GRE) tunnel and an IP Security (IPSec) tunnel), the offered rate does not include all the extra overhead associated with tunnel encapsulation in general. Depending on the configuration, the offered rate may include no overhead, may include the overhead for only *one* tunnel encapsulation, or may include the overhead for *all* tunnel encapsulations. In most of the GRE and IPSec tunnel configurations, the offered rate includes the overhead for GRE tunnel encapsulation only.
drop rate	Rate, in kbps, at which packets are dropped from the class. The drop rate is calculated by subtracting the number of successfully transmitted packets from the offered rate.
Note In distributed architecture platforms (such as the Cisco 7500 series platform), the value of the transfer rate, calculated as the difference between the offered rate and the drop rate counters, can sporadically deviate from the average by up to 20 percent or more. This can occur while no corresponding burst is registered by independent traffic analyzer equipment.	
Match	Match criteria specified for the class of traffic. Choices include criteria such as IP precedence, IP differentiated services code point (DSCP) value, Multiprotocol Label Switching (MPLS) experimental (EXP) value, access groups, and QoS groups. For more information about the variety of match criteria that are available, see the "Classifying Network Traffic" module in the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Table 1-50 show policy-map interface Field Descriptions[1] (continued)

Field	Description
Fields Associated with Queueing (if Enabled)	
Output Queue	The weighted fair queueing (WFQ) conversation to which this class of traffic is allocated.
Bandwidth	Bandwidth, in either kbps or percentage, configured for this class and the burst size.
pkts matched/bytes matched	Number of packets (also shown in bytes) matching this class that were placed in the queue. This number reflects the total number of matching packets queued at any time. Packets matching this class are queued only when congestion exists. If packets match the class but are never queued because the network was not congested, those packets are not included in this total. However, if process switching is in use, the number of packets is always incremented even if the network is not congested.
depth/total drops/no-buffer drops	Number of packets discarded for this class. No-buffer indicates that no memory buffer exists to service the packet.
Fields Associated with Weighted Random Early Detection (WRED) (if Enabled)	
exponential weight	Exponent used in the average queue size calculation for a WRED parameter group.
mean queue depth	Average queue depth based on the actual queue depth on the interface and the exponential weighting constant. It is a fluctuating average. The minimum and maximum thresholds are compared against this value to determine drop decisions.
class	IP precedence level.
Transmitted pkts/bytes	Number of packets (also shown in bytes) passed through WRED and not dropped by WRED. **Note** If there is insufficient memory in the buffer to accommodate the packet, the packet can be dropped *after* the packet passes through WRED. Packets dropped because of insufficient memory in the buffer (sometimes referred to as "no-buffer drops") are not taken into account by the WRED packet counter.
Random drop pkts/bytes	Number of packets (also shown in bytes) randomly dropped when the mean queue depth is between the minimum threshold value and the maximum threshold value for the specified IP precedence level.
Tail drop pkts/bytes	Number of packets dropped when the mean queue depth is greater than the maximum threshold value for the specified IP precedence level.
Minimum thresh	Minimum threshold. Minimum WRED threshold in number of packets.
Maximum thresh	Maximum threshold. Maximum WRED threshold in number of packets.
Mark prob	Mark probability. Fraction of packets dropped when the average queue depth is at the maximum threshold.

Table 1-50 show policy-map interface Field Descriptions[1] (continued)

Field	Description
Fields Associated with Traffic Shaping (if Enabled)	
Target Rate	Rate used for shaping traffic.
Byte Limit	Maximum number of bytes that can be transmitted per interval. Calculated as follows: ((Bc+Be) /8) x 1
Sustain bits/int	Committed burst (Bc) rate.
Excess bits/int	Excess burst (Be) rate.
Interval (ms)	Time interval value in milliseconds (ms).
Increment (bytes)	Number of credits (in bytes) received in the token bucket of the traffic shaper during each time interval.
Queue Depth	Current queue depth of the traffic shaper.
Packets	Total number of packets that have entered the traffic shaper system.
Bytes	Total number of bytes that have entered the traffic shaper system.
Packets Delayed	Total number of packets delayed in the queue of the traffic shaper before being transmitted.
Bytes Delayed	Total number of bytes delayed in the queue of the traffic shaper before being transmitted.
Shaping Active	Indicates whether the traffic shaper is active. For example, if a traffic shaper is active, and the traffic being sent exceeds the traffic shaping rate, a “yes” appears in this field.

1. A number in parentheses may appear next to the service-policy output name, class-map name, and match criteria information. The number is for Cisco internal use only and can be disregarded.

Two-Rate Traffic Policing: Example

The following is sample output from the **show policy-map interface** command when two-rate traffic policing has been configured. In the example below, 1.25 Mbps of traffic is sent (“offered”) to a policer class.

```
Router# show policy-map interface serial3/0

 Serial3/0

  Service-policy output: policy1

   Class-map: police (match all)
    148803 packets, 36605538 bytes
    30 second offered rate 1249000 bps, drop rate 249000 bps
    Match: access-group 101
    police:
     cir 500000 bps, conform-burst 10000, pir 1000000, peak-burst 100000
     conformed 59538 packets, 14646348 bytes; action: transmit
     exceeded 59538 packets, 14646348 bytes; action: set-prec-transmit 2
     violated 29731 packets, 7313826 bytes; action: drop
     conformed 499000 bps, exceed 500000 bps violate 249000 bps
   Class-map: class-default (match-any)
    19 packets, 1990 bytes
    30 seconds offered rate 0 bps, drop rate 0 bps
```

```
    Match: any
```

The two-rate traffic policer marks 500 kbps of traffic as conforming, 500 kbps of traffic as exceeding, and 250 kbps of traffic as violating the specified rate. Packets marked as conforming will be sent as is, and packets marked as exceeding will be marked with IP Precedence 2 and then sent. Packets marked as violating the specified rate are dropped.

Table 1-51 describes the significant fields shown in the display.

Table 1-51 show policy-map interface Field Descriptions—Configured for Two-Rate Traffic Policing

Field	Description
police	Indicates that the **police** command has been configured to enable traffic policing. Also, displays the specified CIR, conform burst size, peak information rate (PIR), and peak burst size used for marking packets.
conformed	Displays the action to be taken on packets conforming to a specified rate. Displays the number of packets and bytes on which the action was taken.
exceeded	Displays the action to be taken on packets exceeding a specified rate. Displays the number of packets and bytes on which the action was taken.
violated	Displays the action to be taken on packets violating a specified rate. Displays the number of packets and bytes on which the action was taken.

Multiple Traffic Policing Actions: Example

The following is sample output from the **show policy-map** command when the Policer Enhancement—Multiple Actions feature has been configured. The sample output from the **show policy-map interface** command displays the statistics for the serial 3/2 interface, to which a service policy called “police” (configured as shown below) is attached.

```
policy-map police
 class class-default
  police cir 1000000 pir 2000000
     conform-action transmit
     exceed-action set-prec-transmit 4
     exceed-action set-frde-transmit
     violate-action set-prec-transmit 2
     violate-action set-frde-transmit

Router# show policy-map interface serial3/2

Serial3/2: DLCI 100 -

Service-policy output: police

    Class-map: class-default (match-any)
      172984 packets, 42553700 bytes
      5 minute offered rate 960000 bps, drop rate 277000 bps
      Match: any
     police:
         cir 1000000 bps, bc 31250 bytes, pir 2000000 bps, be 31250 bytes
       conformed 59679 packets, 14680670 bytes; actions:
         transmit
exceeded 59549 packets, 14649054 bytes; actions:
         set-prec-transmit 4
         set-frde-transmit
       violated 53758 packets, 13224468 bytes; actions:
         set-prec-transmit 2
```

```
    set-frde-transmit
  conformed 340000 bps, exceed 341000 bps, violate 314000 bps
```

The sample output from **show policy-map interface** command shows the following:

- 59679 packets were marked as conforming packets (that is, packets conforming to the CIR) and were transmitted unaltered.
- 59549 packets were marked as exceeding packets (that is, packets exceeding the CIR but not exceeding the PIR). Therefore, the IP Precedence value of these packets was changed to an IP Precedence level of 4, the discard eligibility (DE) bit was set to 1, and the packets were transmitted with these changes.
- 53758 packets were marked as violating packets (that is, exceeding the PIR). Therefore, the IP Precedence value of these packets was changed to an IP Precedence level of 2, the DE bit was set to 1, and the packets were transmitted with these changes.

Note Actions are specified by using the *action* argument of the **police** command. For more information about the available actions, see the **police** command reference page.

Table 1-52 describes the significant fields shown in the display.

Table 1-52 show policy-map interface Field Descriptions—Configured for Multiple Traffic Policing Actions

Field	Description
police	Indicates that the **police** command has been configured to enable traffic policing. Also, displays the specified CIR, conform burst size (BC), PIR, and peak burst size (BE) used for marking packets.
conformed, packets, bytes, actions	Displays the number of packets (also shown in bytes) marked as conforming to a specified rate and the actions taken on the packet. If there are multiple actions, each action is listed separately.
exceeded, packets, bytes, actions	Displays the number of packets (also shown in bytes) marked as exceeding a specified rate and the actions taken on the packet. If there are multiple actions, each action is listed separately.
violated, packets, bytes, actions	Displays the number of packets (also shown in bytes) marked as violating a specified rate and the actions taken on the packet. If there are multiple actions, each action is listed separately.

Percentage-Based Policing and Shaping: Example

The following sample output from the **show policy-map interface** command shows traffic policing configured using a CIR based on a bandwidth of 20 percent. The CIR and committed burst (Bc) in milliseconds (ms) are included in the display.

```
Router# show policy-map interface Serial3/1

 Serial3/1

  Service-policy output: mypolicy

    Class-map: gold (match-any)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match: any
```

```
 police:
     cir 20 % bc 10 ms
     cir 2000000 bps, bc 2500 bytes
     pir 40 % be 20 ms
     pir 4000000 bps, be 10000 bytes
conformed 0 packets, 0 bytes; actions:
 transmit
exceeded 0 packets, 0 bytes; actions:
  drop
 violated 0 packets, 0 bytes; actions:
  drop
 conformed 0 bps, exceed 0 bps, violate 0 bps
```

Table 1-53 describes the significant fields shown in the display.

Table 1-53 show policy-map interface Field Descriptions—Configured for Percentage-Based Policing and Shaping[1]

Field	Description
Service-policy output	Name of the output service policy applied to the specified interface or VC.
Class-map	Class of traffic being displayed. Output is displayed for each configured class in the policy. The choice for implementing class matches (for example, match-all or match-any) can also appear next to the traffic class.
packets, bytes	Number of packets (also shown in bytes) identified as belonging to the class of traffic being displayed.
offered rate	Rate, in kbps, of packets coming in to the class. **Note** If the packets are compressed over an outgoing interface, the improved packet rate achieved by packet compression is not reflected in the offered rate. Also, if the packets are classified *before* they enter a combination of tunnels (for example, a generic routing encapsulation (GRE) tunnel and an IP Security (IPSec) tunnel), the offered rate does not include all the extra overhead associated with tunnel encapsulation in general. Depending on the configuration, the offered rate may include no overhead, may include the overhead for only *one* tunnel encapsulation, or may include the overhead for *all* tunnel encapsulations. In most of the GRE and IPSec tunnel configurations, the offered rate includes the overhead for GRE tunnel encapsulation only.
police	Indicates that traffic policing based on a percentage of bandwidth has been enabled. Also, displays the bandwidth percentage, the CIR, and the committed burst (Bc) size in ms.
conformed, actions	Displays the number of packets and bytes marked as conforming to the specified rates, and the action to be taken on those packets.
exceeded, actions	Displays the number of packets and bytes marked as exceeding the specified rates, and the action to be taken on those packets.

1. A number in parentheses may appear next to the service-policy output name and the class-map name. The number is for Cisco internal use only and can be disregarded.

Traffic Shaping: Example

The following sample output from the **show policy-map interface** command (shown below) displays the statistics for the serial 3/2 interface. Traffic shaping has been enabled on this interface, and an average rate of 20 percent of the bandwidth has been specified.

```
Router# show policy-map interface Serial3/2

Serial3/2

  Service-policy output: p1

    Class-map: c1 (match-all)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match: any
      Traffic Shaping
        Target/Average      Byte   Sustain    Excess      Interval  Increment  Adapt
        Rate              Limit  bits/int  bits/int    (ms)     (bytes)   Active
         20 %                        10 (ms)    20 (ms)
        201500/201500       1952   7808       7808        38         976       -

        Queue     Packets   Bytes     Packets   Bytes     Shaping
        Depth                         Delayed   Delayed   Active
        0         0         0         0         0         no
```

Table 1-54 describes the significant fields shown in the display.

Table 1-54 show policy-map interface Field Descriptions—Configured for Percentage-Based Policing and Shaping (with Traffic Shaping Enabled)[1]

Field	Description
Service-policy output	Name of the output service policy applied to the specified interface or VC.
Class-map	Class of traffic being displayed. Output is displayed for each configured class in the policy. The choice for implementing class matches (for example, match-all or match-any) can also appear next to the traffic class.
packets, bytes	Number of packets (also shown in bytes) identified as belonging to the class of traffic being displayed.
offered rate	Rate, in kbps, of packets coming in to the class. **Note** If the packets are compressed over an outgoing interface, the improved packet rate achieved by packet compression is not reflected in the offered rate. Also, if the packets are classified *before* they enter a combination of tunnels (for example, a generic routing encapsulation (GRE) tunnel and an IP Security (IPSec) tunnel), the offered rate does not include all the extra overhead associated with tunnel encapsulation in general. Depending on the configuration, the offered rate may include no overhead, may include the overhead for only *one* tunnel encapsulation, or may include the overhead for *all* tunnel encapsulations. In most of the GRE and IPSec tunnel configurations, the offered rate includes the overhead for GRE tunnel encapsulation only.
drop rate	Rate, in kbps, at which packets are dropped from the class. The drop rate is calculated by subtracting the number of successfully transmitted packets from the offered rate.

Table 1-54 show policy-map interface Field Descriptions—Configured for Percentage-Based Policing and Shaping (with Traffic Shaping Enabled)[1] (continued)

Field	Description
Match	Match criteria specified for the class of traffic. Choices include criteria such as the Layer 3 packet length, IP precedence, IP DSCP value, MPLS experimental value, access groups, and quality of service (QoS) groups. For more information about the variety of match criteria that are available, see the "Classifying Network Traffic" module in the *Cisco IOS Quality of Service Solutions Configuration Guide*.
Traffic Shaping	Indicates that traffic shaping based on a percentage of bandwidth has been enabled.
Target/Average Rate	Rate (percentage) used for shaping traffic and the number of packets meeting that rate.
Byte Limit	Maximum number of bytes that can be transmitted per interval. Calculated as follows: ((Bc+Be) /8) x 1
Sustain bits/int	Committed burst (Bc) rate.
Excess bits/int	Excess burst (Be) rate.
Interval (ms)	Time interval value in milliseconds (ms).
Increment (bytes)	Number of credits (in bytes) received in the token bucket of the traffic shaper during each time interval.
Adapt Active	Indicates whether adaptive shaping is enabled.
Queue Depth	Current queue depth of the traffic shaper.
Packets	Total number of packets that have entered the traffic shaper system.
Bytes	Total number of bytes that have entered the traffic shaper system.
Packets Delayed	Total number of packets delayed in the queue of the traffic shaper before being transmitted.
Bytes Delayed	Total number of bytes delayed in the queue of the traffic shaper before being transmitted.
Shaping Active	Indicates whether the traffic shaper is active. For example, if a traffic shaper is active, and the traffic being sent exceeds the traffic shaping rate, a "yes" appears in this field.

1. A number in parentheses may appear next to the service-policy output name, class-map name, and match criteria information. The number is for Cisco internal use only and can be disregarded.

Traffic Policing: Example

The following is sample output from the **show policy-map interface** command. This sample displays the statistics for the serial 2/0 interface on which traffic policing has been enabled. The committed (conform) burst (bc) and excess (peak) burst (be) are specified in milliseconds (ms).

```
Router# show policy-map interface serial2/0

 Serial2/0

  Service-policy output: policy1 (1050)
```

```
Class-map: class1 (match-all) (1051/1)
  0 packets, 0 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: ip precedence 0  (1052)
  police:
      cir 20 % bc 300 ms
      cir 409500 bps, bc 15360 bytes
      pir 40 % be 400 ms
      pir 819000 bps, be 40960 bytes
    conformed 0 packets, 0 bytes; actions:
      transmit
    exceeded 0 packets, 0 bytes; actions:
      drop
    violated 0 packets, 0 bytes; actions:
      drop
    conformed 0 bps, exceed 0 bps, violate 0 bps

Class-map: class-default (match-any) (1054/0)
  0 packets, 0 bytes
  5 minute offered rate 0 bps, drop rate 0 bps
  Match: any  (1055)
    0 packets, 0 bytes
    5 minute rate 0 bps
```

In this example, the CIR and PIR are displayed in bps, and both the committed burst (bc) and excess burst (be) are displayed in bits.

The CIR, PIR bc, and be are calculated on the basis of the formulas described below.

Formula for Calculating the CIR: Example

When calculating the CIR, the following formula is used:

- CIR percentage specified (as shown in the output from the **show policy-map** command) * bandwidth (BW) of the interface (as shown in the output from the **show interfaces** command) = total bits per second

According to the output from the **show interfaces** command for the serial 2/0 interface, the interface has a bandwidth (BW) of 2048 kbps.

```
Router# show interfaces serial2/0

Serial2/0 is administratively down, line protocol is down
  Hardware is M4T
  MTU 1500 bytes, BW 2048 Kbit, DLY 20000 usec, rely 255/255, load 1/255
```

The following values are used for calculating the CIR:

20 % * 2048 kbps = 409600 bps

Formula for Calculating the PIR: Example

When calculating the PIR, the following formula is used:

- PIR percentage specified (as shown in the output from the **show policy-map** command) * bandwidth (BW) of the interface (as shown in the output from the **show interfaces** command) = total bits per second

According to the output from the **show interfaces** command for the serial 2/0 interface, the interface has a bandwidth (BW) of 2048 kbps.

```
Router# show interfaces serial2/0
```

```
Serial2/0 is administratively down, line protocol is down
  Hardware is M4T
  MTU 1500 bytes, BW 2048 Kbit, DLY 20000 usec, rely 255/255, load 1/255
```

The following values are used for calculating the PIR:

40 % * 2048 kbps = 819200 bps

Note Discrepancies between this total and the total shown in the output from the **show policy-map interface** command can be attributed to a rounding calculation or to differences associated with the specific interface configuration.

Formula for Calculating the Committed Burst (bc): Example

When calculating the bc, the following formula is used:

- The bc in milliseconds (as shown in the **show policy-map** command) * the CIR in bits per seconds = total number bytes

The following values are used for calculating the bc:

300 ms * 409600 bps = 15360 bytes

Formula for Calculating the Excess Burst (be): Example

When calculating the bc and the be, the following formula is used:

- The be in milliseconds (as shown in the **show policy-map** command) * the PIR in bits per seconds = total number bytes

The following values are used for calculating the be:

400 ms * 819200 bps = 40960 bytes

Table 1-55 describes the significant fields shown in the display.

Table 1-55 show policy-map interface Field Descriptions

Field	Description
Service-policy output	Name of the output service policy applied to the specified interface or VC.
Class-map	Class of traffic being displayed. Output is displayed for each configured class in the policy. The choice for implementing class matches (for example, match-all or match-any) can also appear next to the traffic class.
packets and bytes	Number of packets (also shown in bytes) identified as belonging to the class of traffic being displayed.
offered rate	Rate, in kbps, of packets coming in to the class.
drop rate	Rate, in kbps, at which packets are dropped from the class. The drop rate is calculated by subtracting the number of successfully transmitted packets from the offered rate.

Table 1-55 show policy-map interface Field Descriptions (continued)

Field	Description
Match	Match criteria specified for the class of traffic. Choices include criteria such as the Layer 3 packet length, IP precedence, IP differentiated services code point (DSCP) value, Multiprotocol Label Switching (MPLS) experimental value, access groups, and quality of service (QoS) groups. For more information about the variety of match criteria that are available, see the "Classifying Network Traffic" module in the *Cisco IOS Quality of Service Solutions Configuration Guide*.
police	Indicates that traffic policing has been enabled. Display includes the CIR, PIR (in both a percentage of bandwidth and in bps) and the bc and be in bytes and milliseconds. Also displays the optional conform, exceed, and violate actions, if any, and the statistics associated with these optional actions.

Related Commands

Command	Description
bandwidth remaining ratio	Specifies a bandwidth-remaining ratio for class queues and subinterface-level queues to determine the amount of unused (excess) bandwidth to allocate to the queue during congestion.
class-map	Creates a class map to be used for matching packets to a specified class.
compression header ip	Configures RTP or TCP IP header compression for a specific class.
drop	Configures a traffic class to discard packets belonging to a specific class.
match packet length (class-map)	Specifies the length of the Layer 3 packet in the IP header as a match criterion in a class map.
police	Configures traffic policing.
police (percent)	Configures traffic policing on the basis of a percentage of bandwidth available on an interface.
police (two rates)	Configures traffic policing using two rates, the CIR and the PIR.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
priority	Specifies that low-latency behavior must be given to a traffic class and configures multiple priority queues.
shape (percent)	Specifies average or peak rate traffic shaping on the basis of a percentage of bandwidth available on an interface.
show class-map	Display all class maps and their matching criteria.
show interfaces	Displays statistics for all interfaces configured on a router or access server.
show mls qos	Displays MLS QoS information.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map class	Displays the configuration for the specified class of the specified policy map.

show ppp multilink

To display bundle information for Multilink PPP (MLP) bundles, use the **show ppp multilink** command in privileged EXEC mode.

show ppp multilink [**active | inactive | interface** *bundle-interface* **|** [**username** *name*] [**endpoint** *discriminator*]]

Syntax Description

active	(Optional) Displays information about active multilink bundles only.
inactive	(Optional) Displays information about inactive multilink bundles only.
interface *bundle-interface*	(Optional) Displays information for the specified bundle interface.
username *name*	(Optional) Displays information for all multilink bundles that have the specified peer username.
endpoint *discriminator*	(Optional) Displays information for all multilink bundles that have the specified endpoint discriminator.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.4(19)MR1	This command was integrated into Cisco IOS Release12.4(19)MR1.
12.4(20)MR	This command was modified for the dIPHC and dMLPPP offload features. The command output differs for MLPPP bundles that are offloaded to the network processor.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA. Release 12.2(33)MRA does not support dIPHC.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following is sample output from the **show ppp multilink** command when no bundles are on a system:

```
Router# show ppp multilink

No active bundles
```

The following sample output is for a single bundle that is offloaded to the network processor.

```
Router# show ppp multilink

Multilink1
  Bundle name: pas1_1
  Remote Endpoint Discriminator: [1] pas1_1
  Local Endpoint Discriminator: [1] pas3_1
  Bundle up for 22:58:45, total bandwidth 7936, load 1/255
  Receive buffer limit 48000 bytes, frag timeout 1000 ms
  Distributed MLP bundle status is: tx_active rx_active
    last rx seq no:  0x3E3998
      rx frames:       3
```

```
      rx iw frames:    129369198
      rx err mrru:     0
      rx err iw mru:   0
      rx err iw fbp:   0
      rx flushed:      0
    last tx seq no:  0x4
      tx frames:       4
      tx err mrru:     0

  Member links: 4 active, 0 inactive (max not set, min not set)
    Se0/0:0, since 22:58:46, 7440 weight, 42 frag size, ACT rx link seq:  0x3E399C
    Se0/1:0, since 22:58:46, 7440 weight, 42 frag size, ACT x link seq:  0x3E3997
    Se0/2:0, since 22:58:45, 7440 weight, 42 frag size, ACT rx link seq:  0x3E3995
    Se0/3:0, since 22:58:45, 7440 weight, 42 frag size, ACT rx link seq:  0x3E3996
```

The following is another example of sample output when a single MLP bundle (named 7206-3) is on a system and is not offloaded to the network processor:

```
Router# show ppp multilink

Virtual-Access4
Bundle name: 7206-3
Remote Endpoint Discriminator: [1] 7206-3
Local Endpoint Discriminator: [1] 7206-4
Bundle up for 00:00:07, total bandwidth 64, load 1/255
Receive buffer limit 12192 bytes, frag timeout 1000 ms
 0/0 fragments/bytes in reassembly list
 0 lost fragments, 0 reordered
 0/0 discarded fragments/bytes, 0 lost received
 0x0 received sequence, 0x0 sent sequence
Member links: 1 active, 0 inactive (max not set, min not set)
 BR2/0:1, since 01:59:35, 80 weight, 72 frag size
```

show ptp clock

Displays information about the PTP clock.

show ptp clock

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC

Command History

Release	Modification
12.4(12)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show ptp clock** command to display information about the PTP clock.

Examples

```
Router# show ptp clock
 PTP CLOCK INFO
  PTP Device Type: Ordinary clock
  Clock Identity: 0x0:1E:4A:FF:FF:96:A9:9E
  Clock Domain: 2
  Number of PTP ports: 1
  Priority1: 128
  Priority2: 128
  Clock Quality:
        Class: 13
        Accuracy: Within 1s
        Offset (log variance): 52592
  Offset From Master: 0
  Mean Path Delay: 0
  Steps Removed: 0
  Local clock time: 19:58:40 UTC Oct 30 2000
```

Related Commands

Command	Description
show ptp foreign-master-record	Displays the PTP foreign master records.
show ptp parent	Displays the PTP parent properties.
show ptp port	Displays the PTP port properties.
show ptp time-property	Displays the time properties of the PTP clock.

show ptp foreign-master-record

To display the PTP foreign master record set, use the **show ptp foreign-master-record** command in user EXEC mode.

show ptp foreign-master-record

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC

Command History

Release	Modification
12.4(12)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show ptp foreign-master-record** command to display the PTP foreign master records.

Examples

The following example shows output from the **show ptp foreign-master-record** command:

```
Router# show ptp foreign-master-record
PTP FOREIGN MASTER RECORDS
Interface Vlan2
Number of foreign records 1, max foreign records 5
Best foreign record 0
RECORD #0
Foreign master port identity: clock id: 0x0:1E:4A:FF:FF:96:D2:A9
Foreign master port identity: port num: 1
Number of Announce messages: 8
Number of Current Announce messages: 6
Time stamps: 1233935406, 664274927
```

Related Commands

Command	Description
show ptp clock	Displays information about the PTP clock.
show ptp parent	Displays the PTP parent properties.
show ptp port	Displays the PTP port properties.
show ptp time-property	Displays the time properties of the PTP clock.

show ptp parent

To display the properties of the PTP parent, use the **show ptp parent** command in user EXEC mode.

show ptp parent

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC

Command History

Release	Modification
12.4(12)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show ptp parent** command to display the properties of the PTP parent.

Examples

The following example shows output from the **show ptp parent** command:

```
Router# show ptp parent
PTP PARENT PROPERTIES
  Parent Clock:
  Parent Clock Identity: 0x0:1E:4A:FF:FF:96:A9:9E
  Parent Port Number: 0
  Observed Parent Offset (log variance): N/A
  Observed Parent Clock Phase Change Rate: 0

  Grandmaster Clock:
  Grandmaster Clock Identity: 0x0:1E:4A:FF:FF:96:A9:9E
  Grandmaster Clock Quality:
        Class: 248
        Accuracy: Greater than 10s
        Offset (log variance): 52592
        Priority1: 128
        Priority2: 128
```

Related Commands

Command	Description
show ptp clock	Displays information about the PTP clock.
show ptp foreign-master-record	Displays the PTP foreign master records.
show ptp port	Displays the PTP port properties.
show ptp time-property	Displays the time properties of the PTP clock.

show ptp port

To display the PTP port properties, use the **show ptp port** command in user EXEC mode.

show ptp port

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC

Command History

Release	Modification
12.4(12)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show ptp port** command to o display the PTP port properties.

Examples

The following example shows output from the **show ptp port** command:

```
Router# show ptp port
PTP PORT DATASET: Vlan1
  Port identity: clock identity: 0x0:1E:4A:FF:FF:96:A9:9E
  Port identity: port number: 1
  PTP version: 2
  Delay request interval(log mean): 0
  Announce receipt time out: 0
  Peer mean path delay: 0
  Announce interval(log mean): 0
  Sync interval(log mean): 0
  Delay Mechanism: End to End
  Peer delay request interval(log mean): 0
  Sync fault limit: 6000
```

Related Commands

Command	Description
show ptp clock	Displays information about the PTP clock.
show ptp foreign-master-record	Displays the PTP foreign master records.
show ptp parent	Displays the PTP parent properties.
show ptp time-property	Displays the time properties of the PTP clock.

show ptp time-property

To display the PTP clock time properties, use the **show ptp time-property** command in user EXEC mode.

show ptp time-property

Syntax Description

This command has no arguments or keywords.

Command Modes

User EXEC

Command History

Release	Modification
12.4(12)MR2	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use the **show ptp time-property** command to display PTP clock time properties.

Examples

The following example shows output from the **ptp time-property** command:

```
Router# show ptp time-property
 PTP CLOCK TIME PROPERTY
  Current UTC offset valid: 1
  Current UTC offset: 33
  Leap 59: 0
  Leap 61: 0
  Time Traceable: 0
  Frequency Traceable: 1
  PTP Timescale: 1
  Time Source: Hand Set
```

Related Commands

Command	Description
show ptp clock	Displays information about the PTP clock.
show ptp foreign-master-record	Displays the PTP foreign master records.
show ptp parent	Displays the PTP parent properties.
show ptp port	Displays the PTP port properties.

show pw-udp vc

To display the virtual circuits on a pseudowire connection using UDP encapsulation, use the **show pw-udp vc** command in user EXEC mode.

show pw-udp vc [vcid *vc-id*] **| [vcid** *vc-id-min vc-id-max*] **[destination** *ip-address* **|** *name*] **[detail] [ssm id]**

Syntax Description

vcid	(Optional) Allows you to enter a specific VC ID to display.
vc-id	(Optional) The VC ID number.
vc-id-min *vc-id-max*	(Optional) Allows you to enter a range of VCs to display. The range is from 1 to 4294967295. (This argument is primarily used for legacy implementations.)
destination	(Optional) Information about the VCs that have been assigned VC IDs for the remote router you specify.
ip-address	(Optional) The IP address of the remote router.
name	(Optional) The name assigned to the remote router.
detail	(Optional) Detailed information about the VCs that have been assigned VC IDs.
ssm id	Displays the switch and segment IDs for Synchronization Status Message (SSM)

Command Modes

User EXEC

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command only applies to pseudowire connections using UDP encapsulation.

Examples

The following examples show output from the **show pw-udp vc** command:

```
Router# show pw-udp vc
Local intf     Local circuit              VC ID      Status
-------------- -------------------------- ---------- --------
CE0/0          CESoPSN Basic              1          established
  LAddr: 35.35.35.1      LPort: 50000
  RAddr: 36.36.36.1      RPort: 55000


Router# show pw-udp vc detail
Local intf     Local circuit              VC ID      Status
-------------- -------------------------- ---------- --------
CE0/0          CESoPSN Basic              1          established
  LAddr: 35.35.35.1      LPort: 50000
  RAddr: 36.36.36.1      RPort: 55000
  VC statistics:
    transit packet totals: receive 1153736, send 1153736
    transit byte totals:   receive 286126528, send 286126528
transit packet drops:  receive 0, send 0, seq error 0
```

Related Commands

Command	Description
clear pw_udp vc	Clears counters for virtual circuits on pseudowire connections using UDP encapsulation.

show rep topology

Use the **show rep topology** User EXEC command to display Resilient Ethernet Protocol (REP) topology information for a segment or for all segments, including the primary and secondary edge ports in the segment.

show rep topology [segment *segment_id*] [**archive**] [**detail**] [| {**begin | exclude | include**} *expression*]

Syntax Description

segment-id	(Optional) Display REP topology information for the specified segment. The ID range is from 1 to 1024.
archive	(Optional) Display the previous topology of the segment. This keyword can be useful for troubleshooting a link failure.
detail	(Optional) Display detailed REP topology information.
| begin	(Optional) Display begins with the line that matches the *expression*.
| exclude	(Optional) Display excludes lines that match the *expression*.
| include	(Optional) Display includes lines that match the specified *expression*.
expression	Expression in the output to use as a reference point.

Command Modes

User EXEC

Command History

Release	Modification
12.2(40)SE	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was updated to display information for REP no-neighbor interfaces. The command output displays a * to indicate a no-neighbor interfaces; with the detail keyword, the command output displays **No-Neighbor** next to no-neighbor interfaces.

Usage Guidelines

The output of this command is also included in the **show tech-support** privileged EXEC command output.

Expressions are case sensitive. For example, if you enter **| exclude output**, the lines that contain *output* are not displayed, but the lines that contain *Output* are displayed.

Examples

This is a sample output from the **show rep topology segment** privileged EXEC command:

```
Switch # show rep topology segment 1
REP Segment 1
BridgeName       PortName   Edge Role
---------------- ---------- ---- ----
sw1_multseg_3750 Gi1/1/1    Pri  Alt
sw3_multseg_3400 Gi0/13          Open
sw3_multseg_3400 Gi0/14          Alt
sw4_multseg_3400 Gi0/13          Open
```

```
sw4_multseg_3400 Gi0/14          Open
sw5_multseg_3400 Gi0/13          Open
sw5_multseg_3400 Gi0/14          Open
sw2_multseg_3750 Gi1/1/2         Open
sw2_multseg_3750 Gi1/1/1         Open
sw1_multseg_3750 Gi1/1/2    Sec  Open
```

This is a sample output from the **show rep topology** command when the edge ports are configured to have no REP neighbor:

```
Switch # show rep topology
REP Segment 2
BridgeName       PortName   Edge  Role
---------------- ---------- ----  ----
sw8-ts8-51       Gi0/2      Pri*  Open
sw9-ts11-50      Gi1/0/4          Open
sw9-ts11-50      Gi1/0/2          Open
sw1-ts11-45      Gi0/2            Alt
sw1-ts11-45      Po1              Open
sw8-ts8-51       Gi0/1      Sec*  Open
```

This example shows output from the **show rep topology detail** command:

```
Router# show rep topology detail
REP Segment 2
repc_2_24ts, Fa0/2 (Primary Edge)
  Alternate Port, some vlans blocked
  Bridge MAC: 0019.e714.5380
  Port Number: 004
  Port Priority: 080
  Neighbor Number: 1 / [-10]
repc_3_12cs, Gi0/1 (Intermediate)
  Open Port, all vlans forwarding
  Bridge MAC: 001a.a292.3580
  Port Number: 001
  Port Priority: 000
  Neighbor Number: 2 / [-9]
repc_3_12cs, Po10 (Intermediate)
  Open Port, all vlans forwarding
  Bridge MAC: 001a.a292.3580
  Port Number: 080
  Port Priority: 000
  Neighbor Number: 3 / [-8]
repc_4_12cs, Po10 (Intermediate)
  Open Port, all vlans forwarding
  Bridge MAC: 001a.a19d.7c80
  Port Number: 080
  Port Priority: 000
  Neighbor Number: 4 / [-7]
repc_4_12cs, Gi0/2 (Intermediate)
  Alternate Port, some vlans blocked
  Bridge MAC: 001a.a19d.7c80
  Port Number: 002
  Port Priority: 040
  Neighbor Number: 5 / [-6]

<output truncated>
```

This example shows output from the **show rep topology segment archive** command:

```
Router# show rep topology segment 1 archive
REP Segment 1
BridgeName       PortName   Edge Role
---------------- ---------- ---- ----
sw1_multseg_3750 Gi1/1/1    Pri  Open
sw3_multseg_3400 Gi0/13         Open
sw3_multseg_3400 Gi0/14         Open
sw4_multseg_3400 Gi0/13         Open
sw4_multseg_3400 Gi0/14         Open
sw5_multseg_3400 Gi0/13         Open
sw5_multseg_3400 Gi0/14         Open
sw2_multseg_3750 Gi1/1/2        Alt
sw2_multseg_3750 Gi1/1/1        Open
sw1_multseg_3750 Gi1/1/2    Sec  Open
```

Related Commands

Command	Description
rep segment	Enables REP on an interface and assigns a segment ID. This command is also used to configure a port as an edge port, a primary edge port, or a preferred port.

show storm-control

To display the storm-control configuration on an interface, including the storm-control levels configured on an interface, use the **show storm-control** command in privileged EXEC mode.

show storm-control [**GigabitEthernet** *number*] [**broadcast** | **multicast** | **unicast**] [**GigabitEthernet** *number*]]

Syntax Description

GigabitEthernet *number*	(Optional) Displays broadcast, multicast, or unicast storm control information for a specific interface.
broadcast	(Optional) Displays broadcast storm control information. This is the default.
multicast	(Optional) Displays multicast storm control information.
unicast	(Optional) Displays unicast storm control information.
GigabitEthernet *number*	(Optional) Displays broadcast, multicast, or unicast storm control information for a specific interface.

Defaults

You can display broadcast, multicast, or unicast packet-storm control information by using the corresponding keyword. When **no** keyword option is specified, the default is to display broadcast storm-control information.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(2)XT	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T to support switchport creation on Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
12.2(15)ZJ	This command was integrated into Cisco IOS Release 12.2(15)ZJ and the *interface-type* and *interface-number* arguments and the **broadcast**, **multicast**, **unicast**, and **history** keywords were added to support the Ethernet switch network module on the Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR to support traffic storm control on the Cisco MWR 2941.

Usage Guidelines

You can display broadcast, multicast, or unicast packet-storm control information by using the corresponding keyword. When **no** keyword option is specified, the default is to display broadcast storm-control information.

Examples

The following is partial sample output from the **show storm-controlbroadcast** command when bandwidth-based storm control is configured on an interface:

```
Router# show storm-control broadcast gigabitEthernet 0/1
Interface  Filter State   Trap   State       Upper    Lower    Current   Traps Sent
---------  -------------  ------ -------     -------  -------  -------   ----------
Gi0/4      Forwarding     Above  falling     100.00%  100.00%    0.00%   1
```

The following is partial sample output from the **show storm-controlbroadcast** command when pps-based storm control is configured on an interface:

```
Router#sho storm-control broadcast gigabitEthernet 0/1
Interface  Filter State   Trap State     Upper    Lower    Current     Traps Sent
---------  -------------  ------------  -------  -------  ----------------
Gi0/4      Blocking       Above falling  400 pps  300 pps  74406 pps   1
Router#
```

Table 1-56 show policy-map interface Field Descriptions

Field	Description
Interface	Displays the ID of the interface.
Filter State	Displays the status of the filter: • Blocking--Storm control is enabled, a storm has occurred, and the action is filter. • Forwarding--Storm control is enabled, and a storm has not occurred. • Inactive--Storm control is disabled. • Shutdown--Storm control is enabled, a storm has occurred, and the action is to shut down. **Note** If an interface is disabled by a broadcast, multicast, or unicast storm, the filter state for all traffic types is *shutdown*.
Trap state	Displays the current state of the trap.
Upper	Displays the rising suppression level as a percentage of total available bandwidth or pps.
Lower	Displays the falling suppression level as a percentage of total available bandwidth or pps.
Current	Displays the bandwidth utilization of a specific traffic type as a percentage of total available bandwidth. This field is valid only when storm control is enabled.
Traps sent	Displays the number of traps sent due to a traffic storm.

Related Commands

Command	Description
show storm-control history	Displays interface traffic storm history on a per port basis.
storm-control	Enables broadcast, multicast, or unicast storm control on an interface and specifies the action taken when a storm occurs on an interface.

show storm-control history

To display interface traffic storm history on a per port basis, use the **show storm-control history** command in privileged EXEC mode.

show storm-control history

Syntax Description

There are no key words or arguments.

Defaults

None.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(2)XT	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T to support switchport creation on Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
12.2(15)ZJ	This command was integrated into Cisco IOS Release 12.2(15)ZJ and the *interface-type* and *interface-number* arguments and the **broadcast**, **multicast**, **unicast**, and **history** keywords were added to support the Ethernet switch network module on the Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR to support traffic storm control on the Cisco MWR 2941.

Usage Guidelines

Use the **show storm-control history** command to display a history of traffic storm control by interface.

Examples

The following command displays the traffic storm control history for interfaces on which storm control is configured:

```
Router# show storm-control gi0/1 history
Interface gi0/1 Storm Event History
 Event Type          Event Start Time  Duration (seconds)
 ------------------  ----------------  ------------------
 Unicast             04:58:18          206
 Broadcast           05:01:54          n/a
 Multicast           05:01:54          n/a
 Unicast             05:01:54          108
 Broadcast           05:05:00          n/a
 Multicast           05:05:00          n/a
 Unicast             05:06:00          n/a
 Broadcast           05:09:39          n/a
 Multicast           05:09:39          n/a
 Broadcast           05:11:32          172
```

Related Commands

Command	Description
show storm-control	Displays the packet-storm control information.
storm-control	Enables broadcast, multicast, or unicast storm control on an interface and specifies the action taken when a storm occurs on an interface.

show spanning-tree mst

To display information about the Multiple Spanning Tree (MST) protocol, use the **show spanning-tree mst** command in privileged EXEC mode.

show spanning-tree mst [**configuration** [**digest**]]

show spanning-tree mst [*instance-id*] [**detail**]

show spanning-tree mst [*instance-id*] **interface** *interface* [**detail**]

Syntax Description

configuration	(Optional) Displays information about the region configuration.
digest	(Optional) Displays information about the MD5 digest included in the current MSTCI.
instance-id	(Optional) Instance identification number; valid values are from 0 to 4094.
detail	(Optional) Displays detailed information about the MST protocol.
interface *interface*	(Optional) Displays the interface type and number; possible valid values for type are **ethernet**, **fastethernet**, **gigabitethernet**, **tengigabitethernet**, **pos**, **atm**, **ge-wan**, **port-channel**, and **vlan**. See the "Usage Guidelines" section for valid number values.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.

Release	Modification
12.2(18)SXF	The changes are as follows: • The range of valid values for the *instance-id* changed to 0 to 4094. • The output of the **show spanning-tree mst configuration** command has changed as follows: – Displays the instance identification from 0 to 4094. – Displays the number of the currently configured instances from 0 to 65. – Adds the **digest** keyword to display the MD5 digest of the VLAN-to-instance mapping of the MST configuration. • The output of the **show spanning-tree mst detail** command has changed as follows: – The Regional Root field replaced the IST Master field. – The Internal Path field replaced the Path Cost field. – The Designated Regional Root field replaced the Designated IST Master field. – The txholdcount field was added in the Operational parameter line. • Displays new roles for all MST instances on the CIST root port. • Displays the prestandard flag.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The valid values for *interface* depend on the specified interface type and the chassis and module that are used. For example, if you specify a Gigabit Ethernet interface and have a 48-port 10/100BASE-T Ethernet module that is installed in a 13-slot chassis, valid values for the module number are from 2 to 13 and valid values for the port number are from 1 to 48.

The number of valid values for **port-channel** *number* are a maximum of 64 values ranging from 1 to 282. The **port-channel** *number* values from 257 to 282 are supported on the CSM and the FWSM only.

The number of valid values for **vlan** are from 1 to 4094.

Valid values for *instance-id* are from 0 to 4094.

In the output display of the **show spanning-tree mst configuration** command, a warning message may display. This message appears if you do not map secondary VLANs to the same instance as the associated primary VLAN. The display includes a list of the secondary VLANs that are not mapped to the same instance as the associated primary VLAN. The warning message is as follows:

```
These secondary vlans are not mapped to the same instance as their primary:
-> 3
```

In the output display of the **show spanning-tree mst configuration digest** command, if the output applies to both standard and prestandard bridges at the same time on a per-port basis, two different digests are displayed.

If you configure a port to transmit prestandard BPDUs only, the prestandard flag displays in the **show spanning-tree** commands. The variations of the prestandard flag are as follows:

- Pre-STD (or pre-standard in long format)—This flag displays if the port is configured to transmit prestandard BPDUs and if a prestandard neighbor bridge has been detected on this interface.
- Pre-STD-Cf (or pre-standard (config) in long format)—This flag displays if the port is configured to transmit prestandard BPDUs but a prestandard BPDU has not been received on the port, the autodetection mechanism has failed, or a misconfiguration, if there is no prestandard neighbor, has occurred.
- Pre-STD-Rx (or pre-standard (rcvd) in long format)—This flag displays when a prestandard BPDU has been received on the port but it has not been configured to send prestandard BPDUs. The port will send prestandard BPDUs, but we recommend that you change the port configuration so that the interaction with the prestandard neighbor does not rely only on the autodetection mechanism.

If the configuration is not prestandard compliant, for example, a single MST instance has an ID that is greater than or equal to 16, the prestandard digest is not computed and the following output is displayed:

```
Router# show spanning-tree mst configuration digest
Name      [region1]
Revision  2     Instances configured 3
Digest          0x3C60DBF24B03EBF09C5922F456D18A03
Pre-std Digest  N/A, configuration not pre-standard compatible
Router#
```

MST BPDUs include an MST configuration identifier (MSTCI) that consists of the region name, region revision, and an MD5 digest of the VLAN-to-instance mapping of the MST configuration.

See the **show spanning-tree** command for output definitions.

Examples

This example shows how to display information about the region configuration:

```
Router> show spanning-tree mst configuration

Name      [leo]
Revision  2702
Instance  Vlans mapped
--------  ---------------------------------------------------------------------
0         1-9,11-19,21-29,31-39,41-4094
1         10,20,30,40
-------------------------------------------------------------------------------
```

This example shows how to display additional MST-protocol values:

```
Router# show spanning-tree mst 3 detail

###### MST03 vlans mapped: 3,3000-3999
Bridge address 0002.172c.f400 priority 32771 (32768 sysid 3)
Root this switch for MST03

GigabitEthernet1/1 of MST03 is boundary forwarding
Port info port id 128.1 priority 128
cost 20000
Designated root address 0002.172c.f400 priority 32771
cost 0
Designated bridge address 0002.172c.f400 priority 32771 port
id 128.1
Timers: message expires in 0 sec, forward delay 0, forward transitions 1
Bpdus (MRecords) sent 4, received 0

FastEthernet4/1 of MST03 is designated forwarding
Port info port id 128.193 priority 128 cost
200000
Designated root address 0002.172c.f400 priority 32771
```

```
cost 0
Designated bridge address 0002.172c.f400 priority 32771 port id
128.193
Timers: message expires in 0 sec, forward delay 0, forward transitions 1
Bpdus (MRecords) sent 254, received 1

FastEthernet4/2 of MST03 is backup blocking
Port info port id 128.194 priority 128 cost
200000
Designated root address 0002.172c.f400 priority 32771
cost 0
Designated bridge address 0002.172c.f400 priority 32771 port id
128.193
Timers: message expires in 2 sec, forward delay 0, forward transitions 1
Bpdus (MRecords) sent 3, received 252
Router#
```

This example shows how to display MST information for a specific interface:

```
Router# show spanning-tree mst 0 interface fastethernet 4/1 detail

Edge port: no (trunk) port guard : none
(default)
Link type: point-to-point (point-to-point) bpdu filter: disable
(default)
Boundary : internal bpdu guard : disable
(default)
FastEthernet4/1 of MST00 is designated forwarding
Vlans mapped to MST00 1-2,4-2999,4000-4094
Port info port id 128.193 priority 128 cost
200000
Designated root address 0050.3e66.d000 priority 8193
cost 20004
Designated ist master address 0002.172c.f400 priority 49152
cost 0
Designated bridge address 0002.172c.f400 priority 49152 port id
128.193
Timers: message expires in 0 sec, forward delay 0, forward transitions 1
Bpdus sent 492, received 3
Router#
```

This example shows how to display the MD5 digest included in the current MSTCI:

```
Router# show spanning-tree mst configuration digest

Name      [mst-config]
Revision  10    Instances configured 25
Digest          0x40D5ECA178C657835C83BBCB16723192
Pre-std Digest  0x27BF112A75B72781ED928D9EC5BB4251
Router#
```

This example displays the new master role for all MST instances at the boundary of the region on the port that is a CIST root port:

```
Router# show spanning-tree mst interface fastethernet4/9

FastEthernet4/9 of MST00 is root forwarding
Edge port: no             (default)        port guard : none        (default)
Link type: point-to-point (auto)           bpdu filter: disable     (default)
Boundary : boundary       (RSTP)           bpdu guard : disable     (default)
Bpdus sent 3428, received 6771

Instance Role Sts Cost      Prio.Nbr Vlans mapped
-------- ---- --- --------- -------- --------------------------------
```

```
0        Root FWD 200000    128.201  2-7,10,12-99,101-999,2001-3999,4001-4094
8        Mstr FWD 200000    128.201  8,4000
9        Mstr FWD 200000    128.201  1,9,100
11       Mstr FWD 200000    128.201  11,1000-2000
Router#
```

Related Commands

Command	Description
spanning-tree mst	Sets the path cost and port-priority parameters for any MST instance.
spanning-tree mst forward-time	Sets the forward-delay timer for all the instances on the Catalyst 6500 series switch.
spanning-tree mst hello-time	Sets the hello-time delay timer for all the instances on the Catalyst 6500 series switch.
spanning-tree mst max-hops	Specifies the number of possible hops in the region before a BPDU is discarded.
spanning-tree mst root	Designates the primary and secondary root, sets the bridge priority, and sets the timer value for an instance.

show xconnect

To display information about xconnect attachment circuits and pseudowires (PWs), use the **show xconnect all** command in privileged EXEC mode.

show xconnect {all | interface *interface* **| peer** *ip-address* **{all | vcid** *vcid***}} [detail]**

Syntax Description

all	Displays information about all xconnect attachment circuits and PWs.
interface *interface*	Displays information about xconnect attachment circuits and PWs on the specified interface. Valid values for the argument are as follows: • **atm** *number*—Displays xconnect information for a specific ATM interface or subinterface. • **atm** *number* **vp** *vpi-value*—Displays virtual path (VP) xconnect information for a specific ATM virtual path identifier (VPI). This command does not display information about virtual connect (VC) xconnects using the specified VPI. • **atm** *number* **vp** *vpi-value/vci-value*—Displays VC xconnect information for a specific ATM VPI and virtual circuit identifier (VCI) combination. • **serial** *number*—Displays xconnect information for a specific serial interface. • **serial** *number dlci-number*—Displays xconnect information for a specific Frame Relay data-link connection identifier (DLCI). • **vlan** *vlan-number*—Displays vlan-mode xconnect information for a specific VLAN interface.
peer *ip-address* {**all** | **vcid** *vcid*}	Displays information about xconnect attachment circuits and PWs associated with the specified peer IP address. • **all**—Displays all xconnect information associated with the specified peer IP address. • **vcid** *vcid*—Displays xconnect information associated with the specified peer IP address and the specified VC ID.
detail	(Optional) Displays detailed information about the specified xconnect attachment circuits and PWs.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SRB	This command was updated with the **rib** keyword.
12.2(33)SRC	This command was updated to add SB=Standby and RV=Recovering to the State of the Segment in output displays.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.

Release	Modification
Cisco IOS XE Release 2.1	This command was integrated into Cisco IOS XE Release 2.1.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The **show xconnect all** command can be used to display, sort, and filter basic information about all xconnect attachment circuits and PWs.

You can use the **show xconnect all** command output to help determine the appropriate steps to troubleshoot an xconnect configuration problem. More specific information about a particular type of xconnect can be displayed using the commands listed in the Related Commands table.

Examples

The following example shows **show xconnect all** command output in the brief (default) display format. The output shows information about the interfaces and VCs that have been configured to transport various Layer 2 packets on the router.

```
Router# show xconnect all

Legend: XC ST=Xconnect State, S1=Segment1 State, S2=Segment2 State
UP=Up, DN=Down, AD=Admin Down, IA=Inactive, NH=No Hardware
XC ST     Segment 1  S1 Segment 2 S2
ST     Segment 1                         S1 Segment 2                          S2
------+---------------------------------+--+---------------------------------+--
UP     ac   Et0/0(Ethernet)              UP mpls 10.55.55.2:1000               UP
UP     ac   Et1/0.1:200(Eth VLAN)        UP mpls 10.55.55.2:5200               UP
IA pri ac   Et1/0.2:100(Eth VLAN)        UP ac   Et2/0.2:100(Eth VLAN)         UP
UP sec ac   Et1/0.2:100(Eth VLAN)        UP mpls 10.55.55.3:1101               UP
```

Table 1-57 describes the significant fields shown in the display.

Table 1-57 show xconnect all Field Descriptions

Field	Description
XC ST	• State of the xconnect attachment circuit or PW. Valid states are: • UP—The xconnect attachment circuit or PW is up. Both segment 1 and segment 2 must be up for the xconnect to be up. • DN—The xconnect attachment circuit or PW is down. Either segment 1, segment 2, or both segments are down. • IA—The xconnect attachment circuit or PW is inactive. This state is valid only when PW redundancy is configured. • NH—One or both segments of this xconnect no longer has the required hardware resources available to the system.
Segment 1 or Segment 2	Information about the type of xconnect, the interface type, and the IP address the segment is using. Types of xconnects are: • ac—Attachment circuit. • pri ac—Primary attachment circuit. • sec ac—Secondary attachment circuit. • mpls—Multiprotocol Label Switching. • l2tp—Layer 2 Tunnel Protocol.
S1 or S2	State of the segment. Valid states are: • UP—The segment is up. • DN—The segment is down. • AD—The segment is administratively down.

The following example shows **show xconnect all** command output in the detailed display format:

```
Router# show xconnect all  detail
XC ST  Segment 1                         S1 Segment 2                          S2
------+---------------------------------+--+---------------------------------+--
UP     ac   CE0/0:0(CESoPSN Basic)       UP udp  36.36.36.1:1                  UP
Interworking: none                   pw-class: udpClass01
local: 35.35.35.1:50000
remote: 36.36.36.1:55000
IP: ttl=252, tos=100
```

The additional fields displayed in the detailed output are self-explanatory.

Related Commands

Command	Description
show atm pvc	Displays all ATM PVCs and traffic information.
show atm vc	Displays all ATM PVCs and SVCs and traffic information.
show atm vp	Displays the statistics for all VPs on an interface or for a specific VP.
show connect	Displays configuration information about drop-and-insert connections that have been configured on a router.

Command	Description
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show interfaces	Displays statistics for all interfaces configured on the router or access server.
show mpls l2transport binding	Displays VC label binding information.
show mpls l2transport vc	Displays information about AToM VCs that have been enabled to route Layer 2 packets on a router.

signaling

Specifies the signaling type used on a CEM interface. To disable a signaling configuration, use the **no** form of this command.

signaling [inband-cas]

no signaling [inband-cas]

Syntax Description

inband-cas	Specifies inband channel-associated signaling (CAS) on the CEM interface.

Command Default

This command is disabled by default.

Command Modes

CEM interface configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how the signaling command is used in an E1 controller configuration.

```
Router(config-if)# controller e1 0/0
Router(config-controller)# mode cas
Router(config-controller)# cem-group 0 timeslots 1-31
Router(config-controller)# interface CEM 0/0
Router(config-if)# cem 0
Router(config-if-cem)# signaling inband-cas
Router(config-if-cem)# xconnect 30.30.30.2 305 encapsulation mpls
```

Related Commands

Command	Description
mode cas	Allows you to specify the controller mode for ATM, T1, or E1 controllers and enters controller configuration mode.
cem-group	Creates a circuit emulation (CEM) channel from one or more time slots of a T1 or E1 line.
controller	Configures a T1, E1, or BITS controller and enters controller configuration mode.

snmp-server enable traps ethernet cfm alarm

To enable Ethernet Connectivity Fault Management (CFM) fault alarm traps, use the **snmp-server enable traps ethernet cfm alarm** command in global configuration mode. To disable fault alarm traps, use the **no** form of this command.

snmp-server enable traps ethernet cfm alarm

no snmp-server enable traps ethernet cfm alarm

Syntax Description

This command has no arguments or keywords.

Command Default

Traps are disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRD	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command **t**o turn on or turn off CFM fault alarm traps.

Examples

The following example shows how to enable CFM fault alarm traps:

```
Router#
Router(config)# snmp-server enable traps ethernet cfm alarm
```

snmp-server enable traps ethernet cfm cc

To enable Simple Network Management Protocol (SNMP) trap generation for Ethernet connectivity fault management (CFM) continuity check events, use the **snmp-server enable traps ethernet cfm cc** command in global configuration mode. To disable SNMP trap generation for Ethernet CFM continuity check events, use the **no** form of this command.

snmp-server enable traps ethernet cfm cc [**config**] [**cross-connect**] [**loop**] [**mep-down**] [**mep-up**]

no snmp-server enable traps ethernet cfm cc [**config**] [**cross-connect**] [**loop**] [**mep-down**] [**mep-up**]

Syntax Description

config	(Optional) Generates a trap when a CFM misconfiguration exists in the network.
cross-connect	(Optional) Generates a trap when a cross-connected service exists in the network.
loop	(Optional) Generates a trap when a forwarding loop exists in the network.
mep-down	(Optional) Generates a trap when a device has lost connectivity with a remote MEP or when connectivity from a previously learned remote MEP is restored after interruption.
mep-up	(Optional) Generates a trap when a new remote maintenance endpoint (MEP) has been discovered and learned by the device or when a change occurs in the port state of a previously discovered remote MEP.

Command Default

When no options are configured, all continuity check traps are enabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The configuration error trap (cEtherCfmCcConfigError) is triggered when a device receives a CCM that has the same MPID as a locally configured MEP but a different source MAC Address than its own. The configuration error trap includes the following fields:

- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.

- The MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.
- MPID of local MEP that has the same ID as that received in the CCM.
- Name of the interface on which the MEP above is configured.
- MAC Address of the remote device sending the CCM.

The cross-connect service trap (cEtherCfmCcCrossconnect) is generated when a device receives a continuity check message (CCM) whose service ID is different from what is locally configured on the device for the given service VLAN (S-VLAN). This mismatch indicates that there could be a cross-connected service in the network. The trap includes the following fields:

- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.
- The MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.
- MPID of remote MEP causing the alarm to be raised.
- MAC address of remote MEP causing the alarm to be raised.
- Service ID reported by the remote MEP.

The loop trap (cEtherCfmCcLoop) is generated when a device receives a CCM that has the same source MAC Address and MPID as its own, thereby indicating that the device is receiving its own CCMs and that a forwarding loop exists in the network. The loop trap includes the following fields:

- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.
- The MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.
- MPID of the MEP originating the CCM.
- Name of the interface on which the MEP above is configured.

The mep-down trap (cEtherCfmCcMepDown) notifies the NMS that the device has lost connectivity with a remote MEP. This trap also serves as a clear for Loop, Config, Cross-Connect and Unknown-MEP events.

The mep-down trap is generated in the following cases:

- A valid CCM with a zero hold-time is received from a remote MEP, and the device either has a valid (non-expired) CCDB entry for that MEP or does not have any CCDB entry. In other words, the trap is not generated for an already expired CCDB entry. This trigger has the event code “lastGasp.”
- An entry for a remote MEP in the CCDB expires and is archived. This trigger has the event code “timeout.”
- A previous configuration error trap is cleared. This trigger has the event code “configClear.”
- A previous loop trap is cleared. This trigger has the event code “loopClear.”
- A previous Crossconnect trap is cleared. This trigger has the event code “xconnectClear.”
- A previous unknown trap is cleared. This trigger has the event code “unknownClear.”

The mep-down trap includes the following fields:

- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.
- The MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.
- A count of the local MEPs on the same domain and S-VLAN as the remote MEP that are affected by the event.
- A count of the different interfaces on which the local MEPs above are configured.

- MPID of the remote MEP that is being reported down.
- MAC address of the remote MEP that is being reported down.
- Event code indicating one of the following: lastGasp, timeout, configClear, loopClear, xconnectClear, unknownClear.

The mep-up trap (cEtherCfmCcMepUp) serves three functions. One function is to notify the network management system (NMS) that a new MEP has been discovered and learned by the device. The second function is that the trap notifies the NMS that there is a change in the port-state of a previously discovered remote MEP. The third is to notify the NMS when connectivity from a previously discovered MEP is restored after interruption.

Mep-up traps are suppressed while cross-check is operational because the cross-check traps more efficiently convey the status of the service.

The mep-up trap is generated in the following cases:

- A valid CCM with a non-zero hold-time is received from a remote MEP for the first time, and hence an entry is created for that MEP in the continuity check database (CCDB). This trigger has the event code “new.”
- A valid CCM with a non-zero hold-time is received from a remote MEP for which the device has an expired entry in the CCDB (that is, the device has an entry for that remote MEP in the archived DB). This trigger has the event code “returning.”
- A valid CCM with a non-zero hold-time is received from a remote MEP for which the device has a valid entry in the CCDB and the port-state indicated in the CCM is different from what is cached in the CCDB. This trigger has the event code “portState”

The mep-up trap includes the following fields:

- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.
- The MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.
- A count of the local MEPs on the same domain and S-VLAN as the remote MEP that are affected by the event.
- A count of the different interfaces on which the local MEPs above are configured.
- MPID of the remote MEP that is being reported up.
- MAC address of the remote MEP that is being reported up.
- Event code indicating one of the following: new MEP, returning MEP, or port-state change.
- Port state of remote MEP.

Examples

The following example shows how to enable SNMP trap generation for Ethernet CFM continuity checks when a new remote MEP is discovered and learned by the device:

```
Router(config)# snmp-server enable traps ethernet cfm cc mep-up
```

snmp-server enable traps ethernet cfm crosscheck

To enable Simple Network Management Protocol (SNMP) trap generation for Ethernet connectivity fault management (CFM) continuity check events, in relation to the cross-check operation between statically configured maintenance endpoints (MEPs) and those learned via continuity check messages (CCMs), use the **snmp-server enable traps ethernet cfm crosscheck** command in global configuration mode. To disable SNMP trap generation for these continuity check events, use the **no** form of this command.

snmp-server enable traps ethernet cfm crosscheck [**mep-missing**] [**mep-unknown**] [**service-up**]

no snmp-server enable traps ethernet cfm crosscheck [**mep-missing**] [**mep-unknown**] [**service-up**]

Syntax Description

mep-missing	(Optional) Generates a trap when the cross-check enable timer expires and no CCMs were received from an expected (configured) MEP. One trap is generated per remote MEP.
mep-unknown	(Optional) Generates a trap when an unexpected (unconfigured) MEP comes up. One trap is generated per remote MEP.
service-up	(Optional) Generates a trap when all remote MEPs belonging to a service instance come up.

Command Default

This command is disabled.

When no options are configured, all continuity check event traps are enabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)SRA	This command was introduced.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SXH	This command was integrated into Cisco IOS Release 12.2(33)SXH.
12.2(33)SXI2	This command was integrated into Cisco IOS Release 12.2(33)SXI2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

For this class of traps to function, cross-check must be enabled on the device. Otherwise, none of these traps will be generated, even if they are configured.

The mep-missing trap (cEtherCfmXCheckMissing) notifies the network management system (NMS) that the device did not receive any CCMs from a remote MEP that it was expecting to be part of the service instance.

The mep-missing trap is generated in the following case:

- After enabling cross-check (**ethernet cfm mep crosscheck enable**), the device waits for the cross-check-start timeout value specified (**ethernet cfm mep crosscheck enable-timeout**). When the timeout period has elapsed, the device will cross-check the list of remote MEPs it has learned via CCMs against the static list that has been configured (**mep crosscheck mpid vlan**). For each remote MEP that is configured in the static list and for which the device has not received a CCM, a mep-missing trap is generated.The mep-missing trap has the following fields:
- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.
- MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.
- MPID of the remote MEP that is being reported missing.
- MAC address of the remote MEP that is being reported missing.

The mep-unknown trap (cEtherCfmXCheckUnknown) notifies the NMS that the device received CCMs from a remote MEP that it was not expecting to be part of the service instance.

The mep-unknown trap is generated in the following case:

- After cross-check is in an operational state, the device dynamically examines the list of statically configured remote MEPs against what it learns from CCMs. This occurs after cross-check is enabled and the timer has expired. When the device receives a CCM with non-zero hold time from a remote MEP that does not exist in the static list, the device raises a mep-unknown trap.

The mep-unknown trap has the following fields:

- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.
- MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.
- MPID of the remote MEP that is being reported unknown.
- MAC address of the remote MEP that is being reported unknown.

The service-up trap (cEtherCfmXCheckServiceUp) notifies the NMS that the device received CCMs from all remote MEPs within a given service instance.

The service-up trap is generated in the following case:

- When the device receives CCMs from all remote statically configured MEPs before the expiration of the crosscheck enable-timeout period.

The service-up trap has the following fields:

- Service ID designating the customer service instance to which the event belongs, as configured on the device reporting the event.
- MAC address of the device reporting the event. This is typically the Bridge Brain MAC address.

Examples

The following example shows how to enable SNMP trap generation for Ethernet CFM continuity check events when an unexpected (unconfigured) MEP comes up:

```
Router (config)# snmp-server enable traps ethernet cfm crosscheck mep-unknown
```

Related Commands

Command	Description
ethernet cfm mep crosscheck enable	Enables cross checking between the list of configured remote MEPs of a domain and MEPs learned through CCMs.
mep crosscheck mpid vlan	Statically defines a remote MEP within a maintenance domain.

spanning-tree bpdufilter

To enable bridge protocol data unit (BPDU) filtering on the interface, use the **spanning-tree bpdufilter** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree bpdufilter {**enable** | **disable**}

no spanning-tree bpdufilter

Syntax Description

enable	Enables BPDU filtering on this interface.
disable	Disables BPDU filtering on this interface.

Command Default

The setting that is already configured when you enter the **spanning-tree portfast bpdufilter default** command.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Caution Be careful when you enter the **spanning-tree bpdufilter enable** command. Enabling BPDU filtering on an interface is similar to disabling the spanning tree for this interface. If you do not use this command correctly, you might create bridging loops.

Entering the **spanning-tree bpdufilter enable** command to enable BPDU filtering overrides the PortFast configuration.

When configuring Layer 2-protocol tunneling on all the service-provider edge switches, you must enable spanning-tree BPDU filtering on the 802.1Q tunnel ports by entering the **spanning-tree bpdufilter enable** command.

BPDU filtering prevents a port from sending and receiving BPDUs. The configuration is applicable to the whole interface, whether it is trunking or not. This command has three states:

- **spanning-tree bpdufilter enable**—Unconditionally enables BPDU filtering on the interface.
- **spanning-tree bpdufilter disable**—Unconditionally disables BPDU filtering on the interface.

- **no spanning-tree bpdufilter**—Enables BPDU filtering on the interface if the interface is in operational PortFast state and if you configure the **spanning-tree portfast bpdufilter default** command.

Use the **spanning-tree portfast bpdufilter default** command to enable BPDU filtering on all ports that are already configured for PortFast.

Examples

This example shows how to enable BPDU filtering on this interface:

```
Router(config-if)# spanning-tree bpdufilter enable
Router(config-if)#
```

Related Commands

Command	Description
show spanning-tree	Displays information about the spanning-tree state.
spanning-tree portfast bpdufilter default	Enables BPDU filtering by default on all PortFast ports.

spanning-tree bpduguard

To enable bridge protocol data unit (BPDU) guard on the interface, use the **spanning-tree bpduguard** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree bpduguard {**enable** | **disable**}

no spanning-tree bpduguard

Syntax Description

enable	Enables BPDU guard on this interface.
disable	Disables BPDU guard on this interface.

Command Default

The setting that is already configured when you enter the **spanning-tree portfast bpduguard default** command.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

BPDU guard prevents a port from receiving BPDUs. Typically, this feature is used in a service-provider environment where the network administrator wants to prevent an access port from participating in the spanning tree. If the port still receives a BPDU, it is put in the error-disabled state as a protective measure. This command has three states:

- **spanning-tree bpduguard enable**—Unconditionally enables BPDU guard on the interface.
- **spanning-tree bpduguard disable**—Unconditionally disables BPDU guard on the interface.
- **no spanning-tree bpduguard**—Enables BPDU guard on the interface if it is in the operational PortFast state and if the **spanning-tree portfast bpduguard default** command is configured.

Examples

This example shows how to enable BPDU guard on this interface:

```
Router(config-if)# spanning-tree bpduguard enable
Router(config-if)#
```

Related Commands

Command	Description
show spanning-tree	Displays information about the spanning-tree state.
spanning-tree portfast bpduguard default	Enables BPDU guard by default on all PortFast ports.

spanning-tree guard

To enable or disable the guard mode, use the **spanning-tree guard** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree guard {**loop** | **root** | **none**}

no spanning-tree guard

Syntax Description

loop	Enables the loop-guard mode on the interface.
root	Enables root-guard mode on the interface.
none	Sets the guard mode to none.

Command Default

Guard mode is disabled.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Examples

This example shows how to enable root guard:

```
Router(config-if)# spanning-tree guard root
Router(config-if)#
```

Related Commands

Command	Description
show spanning-tree	Displays information about the spanning-tree state.
spanning-tree loopguard default	Enables loop guard as a default on all ports of a given bridge.

spanning-tree link-type

To configure a link type for a port, use the **spanning-tree link-type** command in the interface configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree link-type {**point-to-point** | **shared**}

no spanning-tree link-type

Syntax Description

point-to-point	Specifies that the interface is a point-to-point link.
shared	Specifies that the interface is a shared medium.

Command Default

Link type is automatically derived from the duplex setting unless you explicitly configure the link type.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Rapid Spanning Tree Protocol Plus (RSTP+) fast transition works only on point-to-point links between two bridges.

By default, the switch derives the link type of a port from the duplex mode. A full-duplex port is considered as a point-to-point link while a half-duplex configuration is assumed to be on a shared link.

If you designate a port as a shared link, RSTP+ fast transition is forbidden, regardless of the duplex setting.

Examples

This example shows how to configure the port as a shared link:

```
Router(config-if)# spanning-tree link-type shared
Router(config-if)#
```

Related Commands

Command	Description
show spanning-tree interface	Displays information about the spanning-tree state.

spanning-tree loopguard default

To enable loop guard as a default on all ports of a given bridge, use the **spanning-tree loopguard default** command in global configuration mode. To disable loop guard, use the **no** form of this command.

spanning-tree loopguard default

no spanning-tree loopguard default

Syntax Description

This command has no arguments or keywords.

Command Default

Loop guard is disabled.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Loop guard provides additional security in the bridge network. Loop guard prevents alternate or root ports from becoming the designated port due to a failure that could lead to a unidirectional link.

Loop guard operates only on ports that are considered point to point by the spanning tree.

The individual loop-guard port configuration overrides this command.

Examples

This example shows how to enable loop guard:

```
Router(config)# spanning-tree loopguard default
Router(config)#
```

Related Commands

Command	Description
show spanning-tree	Displays information about the spanning-tree state.
spanning-tree guard	Enables or disables the guard mode.

spanning-tree mode

To switch between Per-VLAN Spanning Tree+ (PVST+) and Multiple Spanning Tree (MST) modes, use the **spanning-tree mode** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mode [**pvst** | **mst** | **rapid-pvst**]

no spanning-tree mode

Syntax Description

pvst	(Optional) PVST+ mode.
mst	(Optional) MST mode.
rapid-pvst	(Optional) Rapid-PVST+ mode. **Note** Rapid PVST is not supported in Release 15.0(1)MR.

Command Default

pvst

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Caution Be careful when using the **spanning-tree mode** command to switch between PVST+, Rapid-PVST+, and MST modes. When you enter the command, all spanning-tree instances are stopped for the previous mode and are restarted in the new mode. Using this command may cause disruption of user traffic.

Examples

This example shows how to switch to MST mode:

```
Router(config)# spanning-tree mode mst
Router(config)#
```

This example shows how to return to the default mode (PVST+):

```
Router(config)# no spanning-tree mode
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree mst

To set the path cost and port-priority parameters for any Multiple Spanning Tree (MST) instance (including the Common and Internal Spanning Tree [CIST] with instance ID 0), use the **spanning-tree mst** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst *instance-id* {{**cost** *cost* | **port-priority** *priority*} | **pre-standard**}

no spanning-tree mst *instance-id* {{**cost** | **port-priority**} | **pre-standard**}

Syntax Description

instance-id	Instance ID number; valid values are from 0 to 15.
cost *cost*	Path cost for an instance; valid values are from 1 to 200000000.
port-priority *priority*	Port priority for an instance; valid values are from 0 to 240 in increments of 16.
pre-standard	Configures pre-standard MST BPDU transmission on the interface.

Command Default

The defaults are as follows:

- *cost* depends on the port speed; the faster interface speeds indicate smaller costs. MST always uses long path costs.
- *priority* is **128**.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Higher **cost** *cost* values indicate higher costs. When entering the *cost*, do not include a comma in the entry; for example, enter **1000**, not **1,000**.

Higher **port-priority** *prio* values indicate smaller priorities.

Examples

This example shows how to set the interface path cost:

```
Router(config-if)# spanning-tree mst 0 cost 17031970
Router(config-if)#
```

This example shows how to set the interface priority:

```
Router(config-if)# spanning-tree mst 0 port-priority 64
```

```
Router(config-if)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.
spanning-tree port-priority	Sets an interface priority when two bridges vie for position as the root bridge.

spanning-tree mst configuration

To enter MST-configuration submode, use the **spanning-tree mst configuration** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst configuration

no spanning-tree mst configuration

Syntax Description

This command has no arguments or keywords.

Command Default

The default value for the Multiple Spanning Tree (MST) configuration is the default value for all its parameters:

- No VLANs are mapped to any MST instance (all VLANs are mapped to the Common and Internal Spanning Tree [CIST] instance).
- The region name is an empty string.
- The revision number is 0.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

The MST configuration consists of three main parameters:

- Instance VLAN mapping—See the **instance** command
- Region name—See the **name (MST configuration submode)** command
- Configuration revision number—See the **revision** command

The **abort** and **exit** commands allow you to exit MST configuration submode. The difference between the two commands depends on whether you want to save your changes or not.

The **exit** command commits all the changes before leaving MST configuration submode. If you do not map secondary VLANs to the same instance as the associated primary VLAN, when you exit MST-configuration submode, a warning message displays and lists the secondary VLANs that are not mapped to the same instance as the associated primary VLAN. The warning message is as follows:

```
These secondary vlans are not mapped to the same instance as their primary:
-> 3
```

The **abort** command leaves MST-configuration submode without committing any changes.

Changing an MST-configuration submode parameter can cause connectivity loss. To reduce service disruptions, when you enter MST-configuration submode, make changes to a copy of the current MST configuration. When you are done editing the configuration, you can apply all the changes at once by using the **exit** keyword, or you can exit the submode without committing any change to the configuration by using the **abort** keyword.

In the unlikely event that two users commit a new configuration at exactly at the same time, this warning message displays:

```
% MST CFG:Configuration change lost because of concurrent access
```

Examples

This example shows how to enter MST-configuration submode:

```
Router(config)# spanning-tree mst configuration
Router(config-mst)#
```

This example shows how to reset the MST configuration to the default settings:

```
Router(config)# no spanning-tree mst configuration
Router(config)#
```

Related Commands

Command	Description
instance	Maps a VLAN or a set of VLANs to an MST instance.
name (MST)	Sets the name of an MST region.
revision	Sets the revision number for the MST configuration.
show	Verifies the MST configuration.
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree mst forward-time

To set the forward-delay timer for all the instances on the router, use the **spanning-tree mst forward-time** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst forward-time *seconds*

no spanning-tree mst forward-time

Syntax Description

seconds	Number of seconds to set the forward-delay timer for all the instances on the Catalyst 6500 series switch; valid values are from 4 to 30 seconds.

Command Default

seconds is **15**.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Examples

This example shows how to set the forward-delay timer:

```
Router(config)# spanning-tree mst forward-time 20
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree mst hello-time

To set the hello-time delay timer for all the instances on the router, use the **spanning-tree mst hello-time** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst hello-time *seconds*

no spanning-tree mst hello-time

Syntax Description

seconds	Number of seconds to set the hello-time delay timer for all the instances on the Catalyst 6500 series switch; valid values are from 1 to 10 seconds.

Command Default

2 seconds

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

If you do not specify the *hello-time* value, the value is calculated from the network diameter.

Examples

This example shows how to set the hello-time delay timer:

```
Router(config)# spanning-tree mst hello-time 3
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree mst max-age

To set the max-age timer for all the instances on the router, use the **spanning-tree mst max-age** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst max-age *seconds*

no spanning-tree mst max-age

Syntax Description

seconds	Number of seconds to set the max-age timer for all the instances on the router; valid values are from 6 to 40 seconds.

Command Default

20 seconds

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Examples

This example shows how to set the max-age timer:

```
Router(config)# spanning-tree mst max-age 40
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree mst max-hops

To specify the number of possible hops in the region before a bridge protocol data unit (BPDU) is discarded, use the **spanning-tree mst max-hops** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst max-hops *hopnumber*

no spanning-tree mst max-hops

Syntax Description

hopnumber	Number of possible hops in the region before a BPDU is discarded; valid values are from 1 to 255 hops.

Command Default

20 hops

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(18)SXF	This command was changed to increase the maximum number of possible hops from 40 to 255 hops.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Examples

This example shows how to set the number of possible hops:

```
Router(config)# spanning-tree mst max-hops 25
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree mst priority

To specify a bridge priority for the spanning tree, use the **spanning-tree mst priority** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst *instance* **priority** *priority*

no spanning-tree mst priority

Syntax Description

instance	Instance identification number; valid values are from 0 to 4094.
priority *priority*	Specifies the bridge priority; see the "Usage Guidelines" section for valid values and additional information.

Command Default

priority is **32768**.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

You can set the bridge priority in increments of 4096 only. When you set the priority, valid values are **0**, **4096**, **8192**, **12288**, **16384**, **20480**, **24576**, **28672**, **32768**, **36864**, **40960**, **45056**, **49152**, **53248**, **57344**, and **61440**.

You can set the *priority* to **0** to make the switch root.

You can enter *instance* as a single instance or a range of instances, for example, 0-3,5,7-9.

Examples

This example shows how to set the bridge priority:

```
Router(config)# spanning-tree mst 0 priority 4096
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree mst root

To designate the primary and secondary root, set the bridge priority, and set the timer value for an instance, use the **spanning-tree mst root** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree mst *instance* **root** {**primary** | **secondary**} [**diameter** *diameter* [**hello-time** *time*]]

no spanning-tree mst root

Syntax Description

instance	Instance identification number; valid values are from 0 to 4094.
primary	Specifies the high enough priority (low value) to make the bridge root of the spanning-tree instance.
secondary	Specifies the switch as a secondary root, should the primary root fail.
diameter *diameter*	(Optional) Specifies the timer values for the bridge that are based on the network diameter; valid values are from 1 to 7.
hello-time *time*	(Optional) Specifies the duration between the generation of configuration messages by the root switch.

Command Default

None

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

You can enter *instance* as a single instance or a range of instances; for example, 0-3,5,7-9.

The **spanning-tree mst root secondary** bridge priority value is 16384.

The **diameter** *diameter* and **hello-time** *time* keywords and arguments are available for instance 0 only.

If you do not specify the *time* argument, the value for it is calculated from the network diameter.

Examples

This example shows how to set the priority and timer values for the bridge:

```
Router(config)# spanning-tree mst 0 root primary diameter 7 hello-time 2
Router(config)# spanning-tree mst 5 root primary
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.

spanning-tree portfast (interface)

To enable PortFast mode where the interface is immediately put into the forwarding state upon linkup without waiting for the timer to expire, use the **spanning-tree portfast** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree portfast

spanning-tree portfast {**disable | edge** [**trunk**] | **network | trunk**}

no spanning-tree portfast

Syntax Description

disable	Disables PortFast on the interface.
edge	Enables PortFast edge mode on the interface.
network	Enables PortFast network mode on the interface.
trunk	Enables PortFast on the interface even in the trunk mode.

Command Default

The settings that are configured by the **spanning-tree portfast default** command.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXI	Added **edge** [**trunk**] and **network** keywords.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

You should use this command only with interfaces that connect to end stations; otherwise, an accidental topology loop could cause a data-packet loop and disrupt the Catalyst 6500 series switch and network operation.

An interface with PortFast mode enabled is moved directly to the spanning-tree forwarding state when linkup occurs without waiting for the standard forward-time delay.

Be careful when using the **no spanning-tree portfast** command. This command does not disable PortFast if the **spanning-tree portfast default** command is enabled.

This command has these states:

- **spanning-tree portfast**—This command enables PortFast unconditionally on the given port.
- **spanning-tree portfast disable**—This command explicitly disables PortFast for the given port. The configuration line shows up in the running configuration because it is not the default.

- **spanning-tree portfast edge**—This command allows you to configure PortFast edge mode on the given port.
- **spanning-tree portfast network**—This command allows you to configure PortFast network mode on the given port.
- **spanning-tree portfast** [**edge**] **trunk**—This command allows you to configure PortFast on trunk ports. The **edge** keyword is required with **trunk** in Cisco IOS Release 12.2(33)SXI and later releases.

Note If you enter the **spanning-tree portfast trunk** command, the port is configured for PortFast even in the access mode.

- **no spanning-tree portfast**—This command implicitly enables PortFast if you define the **spanning-tree portfast default** command in global configuration mode and if the port is not a trunk port. If you do not configure PortFast globally, the **no spanning-tree portfast** command is equivalent to the **spanning-tree portfast disable** command.

Examples

This example shows how to enable PortFast mode in releases earlier than Cisco IOS Release 12.2(33)SXI:

```
Router(config-if)# spanning-tree portfast
Router(config-if)#
```

This example shows how to enable PortFast edge mode in Cisco IOS Release 12.2(33)SXI and later releases:

```
Router(config-if)# spanning-tree portfast edge
Router(config-if)#
```

Related Commands

Command	Description
show spanning-tree	Displays information about the spanning-tree state.
spanning-tree portfast default	Enables PortFast by default on all access ports.

spanning-tree portfast bpdufilter default

To enable bridge protocol data unit (BPDU) filtering by default on all PortFast ports, use the **spanning-tree portfast bpdufilter default** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree portfast bpdufilter default

no spanning-tree portfast bpdufilter default

Syntax Description

This command has no arguments or keywords.

Command Default

Disabled

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

The **spanning-tree portfast bpdufilter** command enables BPDU filtering globally on PortFast ports. BPDU filtering prevents a port from sending or receiving any BPDUs.

You can override the effects of the **portfast bpdufilter default** command by configuring BPDU filtering at the interface level.

Note Be careful when enabling BPDU filtering. The feature's functionality is different when you enable it on a per-port basis or globally. When enabled globally, BPDU filtering is applied only on ports that are in an operational PortFast state. Ports send a few BPDUs at linkup before they effectively filter outbound BPDUs. If a BPDU is received on an edge port, it immediately loses its operational PortFast status and BPDU filtering is disabled.

When enabled locally on a port, BPDU filtering prevents the Catalyst 6500 series switch from receiving or sending BPDUs on this port.

Caution Be careful when using this command. Using this command incorrectly can cause bridging loops.

Examples

This example shows how to enable BPDU filtering by default:

```
Router(config)# spanning-tree portfast bpdufilter default
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.
spanning-tree bpdufilter	Enables BPDU filtering on the interface.

spanning-tree portfast bpduguard default

To enable bridge protocol data unit (BPDU) guard by default on all PortFast ports, use the **spanning-tree portfast bpduguard default** command in global configuration mode. To return to the default settings, use the **no** form of this command.

spanning-tree portfast bpduguard default

no spanning-tree portfast bpduguard default

Syntax Description

This command has no arguments or keywords.

Command Default

Disabled

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Caution Be careful when using this command. You should use this command only with interfaces that connect to end stations; otherwise, an accidental topology loop could cause a data-packet loop and disrupt the Catalyst 6500 series switch and network operation.

BPDU guard disables a port if it receives a BPDU. BPDU guard is applied only on ports that are PortFast enabled and are in an operational PortFast state.

Examples

This example shows how to enable BPDU guard by default:

```
Router(config)# spanning-tree portfast bpduguard default
Router(config)#
```

Related Commands

Command	Description
show spanning-tree mst	Displays the information about the MST protocol.
spanning-tree bpdufilter	Enables BPDU filtering on the interface.

spanning-tree portfast default

To enable PortFast by default on all access ports, use the **spanning-tree portfast default** command in global configuration mode. To disable PortFast by default on all access ports, use the **no** form of this command.

spanning-tree portfast {**edge** [**bpdufilter** | **bpduguard**] | **network** | **normal**} **default**

no spanning-tree portfast {**edge** [**bpdufilter** | **bpduguard**] | **network** | **normal**} **default**

Syntax Description

bpdufilter	Enables PortFast edge BPDU filter by default on all PortFast edge ports.
bpduguard	Enables PortFast edge BPDU guard by default on all PortFast edge ports.
edge	Enables PortFast edge mode by default on all switch access ports.
network	Enables PortFast network mode by default on all switch access ports.
normal	Enables PortFast normal mode by default on all switch access ports.

Note These keywords are available only in Cisco IOS Release 12.2(33)SXI and later releases.

Command Default

PortFast is disabled by default on all access ports.

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXI	Mode settings (edge, network, and normal) and BPDU filter and BPDU guard settings were added.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Caution Be careful when using this command. You should use this command only with interfaces that connect to end stations; otherwise, an accidental topology loop could cause a data-packet loop and disrupt the operation of the router or switch and the network.

An interface with PortFast mode enabled is moved directly to the spanning-tree forwarding state when linkup occurs without waiting for the standard forward-time delay.

You can enable PortFast mode on individual interfaces using the **spanning-tree portfast (interface)** command.

Examples

This example shows how to enable PortFast by default on all access ports in releases earlier than Cisco IOS Release 12.2(33)SXI:

```
Router(config)# spanning-tree portfast default
Router(config)#
```

This example shows how to enable PortFast edge mode with BPDU Guard by default on all access ports in Cisco IOS Release 12.2(33)SXI and later releases:

```
Router(config)# spanning-tree portfast edge bpduguard default
Router(config)#
```

Related Commands

Command	Description
show spanning-tree	Displays information about the spanning-tree state.
spanning-tree portfast (interface)	Enables PortFast on a specific interface.

ssm

To enable the use of the Synchronization Status Message (SSM) on a synchronous Ethernet connection, use the **ssm** command in controller configuration mode. To disable this feature, use the **no** form of this command.

ssm

no ssm

Syntax Description

This command has no arguments or keywords.

Command Default

This command is disabled by default.

Command Modes

Controller configuration mode (config-controller)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

The SSM informs network nodes about the quality level of the clock so that each node can select the best available clock source. The SSM also helps prevent timing loops and detect clocking failures. For more information about the SSM, see the *Cisco MWR 2941-DC Mobile Wireless Edge Router Software Configuration Guide.*.

Examples

The following example shows how to use the **ssm** command:

```
Router(config)# controller BITS
Router(config-controller)# applique E1
Router(config-controller)# framing crc4
Router(config-controller)# ssm
```

Related Commands

Command	Description
sabit	Specifies the S_a bit used to carry the Synchronization Status Message (SSM) for synchronous Ethernet.

storm-control

To enable bandwidth- or packets per second (PPS)-based broadcast, multicast, or unicast storm control on a port or to specify the action taken when a storm occurs on a port, use the **storm-control** command in interface configuration mode. To disable storm control for broadcast, multicast, or unicast traffic or to disable the specified storm-control action, use the **no** form of this command.

storm-control {{**broadcast** | **multicast** | **unicast**} {**level** *level* | **level pps** *rate*} [**action** [**shutdown** | **trap**]]}

no storm-control {{**broadcast** | **multicast** | **unicast**} {**level** *level* | **level pps** *rate*} [**action** [**shutdown** | **trap**]]}

storm-control action {**shutdown** | **trap**}

Syntax Description

action	Action taken when a storm occurs on an interface. By default, packets are dropped when a storm occurs on a interface. Optionally, specifying: • **shutdown**—Disables the interface if a traffic storm occurs. • **trap**—Sends an SNMP trap if a traffic storm occurs.
broadcast	Enables broadcast address storm control on the interface.
multicast	Enables multicast address storm control on the interface.
unicast	Enables unicast address storm control on the interface.
level *level*	Sets the rising suppression level as a percent of total bandwidth, up to two decimal places. Valid values are from 0 (port forwards no traffic) to 100 (no storm control active). When the value specified for level is reached, the flooding of storm packets is blocked.
level pps *rate*	Defines the rising suppression level in PPS. Valid values are 0 (port forwards no traffic) to 42949672950.

Defaults

Broadcast, multicast, and unicast storm control is disabled. The default action is to send all traffic.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
12.2(2)XT	This command was introduced on Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T to support switchport creation on Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.

Release	Modification
12.2(15)ZJ	This command was integrated into Cisco IOS Release 12.2(15)ZJ and the **level** keyword, the *lower-level* argument, and the **action** and **shutdown** keywords were added to support the Ethernet switch network module on Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
15.1(3)MR	This command was integrated into Cisco IOS Release 15.1(3)MR to support traffic storm control on the Cisco MWR 2941 and the **level pps** keyword option was added to support the configuration of PPS-based traffic storm control on the Cisco MWR 2941.

Usage Guidelines

Use the **storm-control** command to enable or disable bandwidth-based or PPS-based broadcast, multicast, or unicast storm control on a port. If a port is disabled during a storm, use the **no** form of the **shutdown interface** configuration command to enable the port.

The suppression levels are entered as a percentage of total bandwidth or PPS.

At the start of a hard-coded defined time period (10 milliseconds [mSec]) the Cisco MWR 2941 starts counting the number of bytes or PPS on that interface. With bandwidth-based storm control, when the number of bytes received causes the traffic to exceed the percentage bandwidth configured on that interface, traffic is dropped for the remainder of the time period. With PPS-based storm control, when the number of packets received exceeds the PPS configured on that interface, traffic is dropped for the remainder of the time period.

For example, if an operator configures the storm control threshold as 10% for a 1000 Mbps port, the traffic allowed to pass during in 10 mSec is 1000 M*0.1*0.01 bits.

By default, when storm control occurs, traffic is dropped. Optionally, you can configure the router to shutdown the port on which a storm is occurring or send an SNMP trap by using the **action** keyword option.

When configuring traffic storm control support on the Cisco MWR 2941, note the following:

- The Cisco MWR 2941 does not support storm control on a port-channel interface.
- Storm control on the Cisco MWR 2941 does not control protocol data units (PDUs).
- In the **show interface counters** command output, multicast packets are counted as unicast packets.
- The following SNMP trap message applies to all traffic (broadcast, multicast, and unicast) storm detection:

```
%MWR2900_STORM_CONTROL-2-TRAP: Storm control Sending SNMP trap
GigabitEthernet{slot/port}.
```

- The Cisco MWR 2941 does not support the debugging of traffic storm control.

Examples

The following example shows how to enable broadcast storm control on a port with a 75.67 percent rising suppression level:

```
Router(config-if)# storm-control broadcast level 75.67
```

The following example shows how to enable broadcast storm control on a port with a 400000 pps output rate suppression level:

```
Router(config-if)# storm-control broadcast level pps 4000000.67
```

The following example shows how to enable the shutdown action on a port:

```
Router(config-if)# storm-control action shutdown
```

The following example shows how to disable the shutdown action on a port:

```
Router(config-if)# no storm-control action shutdown
```

The following example shows how to enable the trap action on a port:

```
Router(config-if)# storm-control action trap
```

The following example shows how to disable the trap action on a port:

```
Router(config-if)# no storm-control action trap
```

Related Commands

Command	Description
show storm-control	Displays storm-control levels set on the interface.
show storm-control history	Displays interface traffic storm history on a per port basis.
shutdown (interface)	Disables an interface.

switch l2trust

Enables layer 2 trust mode on the Cisco MWR 2941 gigabitEthernet ports. To disable layer 2 trust mode, use the **no** form of this command.

switch l2trust

no switch l2trust

Command Default

This command is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
12.4(20)MR	This command was introduced.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

This command enables layer 2 trusted mode for all gigabitEthernet ports on the 12.2(33)MRA.

Examples

The following example shows the output generated by this command:

```
Router(config)# switch l2trust
Router(config)# exit
```

Related Commands

Command	Description
show interface switchport backup	Displays status information about the backup switchport.

switch tail-drop accounting

Tail drop accounting allows you to monitor QoS packet drops on the router. To enable tail drop accounting on an interface or on a specific queue on an interface, use the **switch tail-drop accounting** command in global configuration mode. To disable tail-drop accounting, use the **no** form of this command.

switch tail-drop accounting interface *interface-name [***queue** *queue-number]*

no switch tail-drop accounting interface *interface-name [***queue** *queue-number]*

Syntax Description

interface-name	The interface on which to enable tail drop accounting.
queue-number	(Optional) The queue on which to enable tail drop accounting.

Command Default

None

Command Modes

Global configuration (config)

Command History

Release	Modification
12.2(33)MRB4	This command was introduced.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You can use tail drop accounting to monitor packet drops on an interface or queue on a per-class or per-port basis.

You can enable tail-drop accounting on the following at a given time:

- Up to 2 queues
- Up to 2 interfaces
- 1 queue and 1 interface

You can use the CISCO-CLASS-BASED-QOS-MIB for for tail drop monitoring. For more information, see the *Release Notes for Cisco MWR 2941 Mobile Wireless Edge Router for Cisco IOS Release 15.0(1)MR*.

Examples

The following examples show how to use the **switch tail-drop accounting** command.

- Enabling tail drop accounting on an interface:

```
Router(config)# switch tail-drop accounting gigabitethernet0/5
```

- Enabling tail drop accounting on a queue:

```
Router(config)# switch tail-drop accounting gigabitethernet0/5 queue 5
```

- Disabling tail drop accounting on an interface:

```
Router(config)# no switch tail-drop accounting gigabitethernet0/5
```

Note Disabling tail drop accounting on an interface disables tail drop accounting on all queues of the interface.

- Disabling tail drop accounting on a queue:

```
Router(config)# no switch tail-drop accounting gigabitethernet0/5 queue 5
```

Related Commands

Command	Description
clear switch tail-drop accounting	Resets the tail drop accounting counters to zero.

switchport access vlan

To set the VLAN when the interface is in access mode, use the **switchport access vlan** command in interface configuration mode. To reset the access-mode VLAN to the appropriate default VLAN for the device, use the **no** form of this command.

switchport access vlan *vlan-id*

no switchport access vlan

Syntax Description

vlan-id	VLAN that is to be set when the interface is in access mode; valid values are from 1 to 4094.

Command Default

The defaults are:

- Access VLAN and trunk-interface native VLAN are default VLANs that correspond to the platform or interface hardware.
- All VLAN lists include all VLANs.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Release 12.2(17d)SXB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You must enter the **switchport** command without any keywords to configure the LAN interface as a Layer 2 interface before you can enter the **switchport access vlan** command. This action is required only if you have not entered the **switchport** command for the interface.

Entering the **no switchport** command shuts down the port and then reenables it. This action may generate messages on the device to which the port is connected.

The **no** form of the **switchport access vlan** command resets the access-mode VLAN to the appropriate default VLAN for the device.

Examples

This example shows how to cause the port interface to stop operating as a Cisco-routed port and convert to a Layer 2 switched interface:

```
Router(config-if)# switchport
```

Note The **switchport** command is not used on platforms that do not support Cisco-routed ports. All physical ports on such platforms are assumed to be Layer 2-switched interfaces.

This example shows how to cause a port interface that has already been configured as a switched interface to operate in VLAN 2 instead of the platform's default VLAN in the interface-configuration mode:

```
Router(config-if)# switchport access vlan 2
```

Related Commands

Command	Description
show interfaces switchport	Displays the administrative and operational status of a switching (nonrouting) port.
switchport	Configures a LAN interface as a Layer 2 interface.

switchport backup

Use the **switchport backup interface** interface configuration command on a Layer 2 interface to configure Flex Links, a pair of interfaces that provide backup to each other. Use the **no** form of this command to remove the Flex Links configuration.

switchport backup interface {*interface-id*}

no switchport backup interface {*interface-id*}

Syntax Description

interface-id	The Layer 2 interface that acts as a backup link to the interface being configured. The interface can be a physical interface or port channel. The port-channel range is 1–486.

Defaults

There is no default setting.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(18)SXF	Support for this command was introduced on the Supervisor Engine 720.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Examples

The following example shows the output generated by this command:

```
Router(config)# interface gigabitethernet0/3
Router(config-if)# switchport backup interface gigabitethernet0/4
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
show interface switchport backup	Displays status information about the backup switchport.

switchport mode

To set the interface type, use the **switchport mode** command in interface configuration mode. Use the appropriate **no** form of this command to reset the mode to the appropriate default mode for the device.

switchport mode {**access** | **dot1q-tunnel** | **dynamic** {**auto** | **desirable**} | **trunk**}

no switchport mode

Syntax Description

access	Sets a nontrunking, nontagged single VLAN Layer 2 interface.
dot1q-tunnel	Sets the trunking mode to TUNNEL unconditionally.
dynamic auto	Sets the interface to convert the link to a trunk link.
dynamic desirable	Sets the interface to actively attempt to convert the link to a trunk link.
trunk	Specifies a trunking VLAN Layer 2 interface.

Command Default

The default setting is **dynamic auto.**

Command Modes

Interface configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced on the Cisco Catalyst 6000 family switches.
12.1(1)E	This command was integrated on the Cisco Catalyst 6000 family switches.
12.1(8a)EX	The switchport mode **private-vlan** {**host** | **promiscuous**} syntax was added.
12.2(2)XT	Creation of switchports became available on Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T for creation of switchports on Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.
12.2(14)SX	Support for this command was introduced on the Supervisor Engine 720.
12.2(17d)SXB	Support for this command on the Supervisor Engine 2 was extended to Cisco IOS Release 12.2(17d)SXB.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Usage Guidelines

Cisco 2600 Series, Cisco 3600 Series, and Cisco 3700 Series Routers

If you enter a forced mode, the interface does not negotiate the link to the neighboring interface. Ensure that the interface ends match each other.

The **no** form of the command is not supported on the Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series routers.

Cisco Catalyst 6500/6000 Switches and Cisco 7600 Series Routers

If you enter **access** mode, the interface goes into permanent nontrunking mode and negotiates to convert the link into a nontrunk link even if the neighboring interface does not agree to the change.

If you enter **trunk** mode, the interface goes into permanent trunking mode and negotiates to convert the link into a trunk link even if the neighboring interface does not agree to the change.

If you enter **dynamic auto** mode, the interface converts the link to a trunk link if the neighboring interface is set to **trunk** or **desirable** mode.

If you enter **dynamic desirable** mode, the interface becomes a trunk interface if the neighboring interface is set to **trunk**, **desirable**, or **auto** mode.

If you configure a port as a promiscuous or host-PVLAN port and one of the following applies, the port becomes inactive:

- The port does not have a valid PVLAN association or mapping configured.
- The port is a SPAN destination.

If you delete a private-port PVLAN association or mapping, or if you configure a private port as a SPAN destination, the deleted private-port PVLAN association or mapping or the private port that is configured as a SPAN destination becomes inactive.

If you enter **dot1q-tunnel** mode, PortFast Bridge Protocol Data Unit (BPDU) filtering is enabled and Cisco Discovery Protocol (CDP) is disabled on protocol-tunneled interfaces.

Examples

The following example shows how to set the interface to **access** desirable mode:

```
Router(config-if)# switchport mode access
```

The following example shows how to set the interface to **trunk** mode:

```
Router(config-if)# switchport mode trunk
```

The following example shows how to set the interface to dynamic desirable mode:

```
Router(config-if)# switchport mode dynamic desirable
```

Related Commands

Command	Description
show dot1q-tunnel	Displays a list of 802.1Q tunnel-enabled ports.
show interfaces switchport	Displays administrative and operational status of a switching (nonrouting) port.
show interfaces trunk	Displays trunk information.
switchport	Modifies the switching characteristics of the Layer 2-switched interface.
switchport private-vlan host-association	Defines a PVLAN association for an isolated or community port.
switchport private-vlan mapping	Defines the PVLAN mapping for a promiscuous port.
switchport trunk	Sets trunk characteristics when the interface is in trunking mode.

switchport priority default

To configure a default priority value for ingress traffic on an interface, use the **switchport priority default** command in interface configuration mode. To remove a default priority configuration, use the **no** form of this command.

switchport priority default *priority*

no switchport priority default *priority*

Syntax Description

priority	The priority value assigned to ingress traffic. Valid values are from 0 to 7.

Defaults

No default settings or behaviors.

Command Modes

Interface configuration

Command History

Release	Modification
15.0(2)MR	This command was introduced.

Usage Guidelines

To configure the Cisco MWR 2941 to overwrite the priority value of a packet, use the **switchport priority override** command.

Examples

The following example shows how to use the **switchport priority default** command:

```
Router# configure terminal
Router(config)# interface FastEthernet1/7
Router(config-if)# switchport mode trunk
Router(config-if)# switchport priority default 7
```

Related Commands

Command	Description
switchport priority override	Displays a list of 802.1Q tunnel-enabled ports.

switchport priority override

To configure the router to override the priority value of ingress traffic on an interface, use the switchport priority override command in interface configuration mode. To disable a priority override configuration, use the **no** form of this command.

switchport priority override

no switchport priority override

Syntax Description

No arguments or keywords.

Defaults

This command is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
15.0(2)MR	This command was introduced.

Usage Guidelines

To configure the default priority value used to overwrite the priority value of incoming traffic, use the **switchport priority default** command.

If you configure switchport priority override without specifying a default priority value using the **switchport priority default** command, the router assigns a priority value of 0.

Examples

The following example shows how to use the **switchport priority override** command:

```
Router# configure terminal
Router(config)# interface FastEthernet1/7
Router(config-if)# switchport mode trunk
Router(config-if)# switchport priority default 7
Router(config-if)# switchport priority override
```

Related Commands

Command	Description
switchport priority default	Configures a default priority value for ingress traffic on an interface.

switchport stacking-partner

Stacking allows you to configure two switch modules in a single chassis to behave as a single switch. This is done by selecting one port from each switch module and configuring it to be a stacking partner. You must then use a cable to connect the stacking partners from each switch module to physically stack the switch modules. Any one port in a switch module can be designated as the stacking partner for that switch module.

Use the **switchport stacking-partner** command to configure a stacking partner port. You can use this command on the onboard gigabitEthernet ports or on fastEthernet ports on the HWIC-D-9ESW card. Use the **no** form of this command to remove the configuration.

switchport stacking-partner interface gigabitethernet ***partner-interface-id***

no switchport stacking-partner interface gigabitethernet ***partner-interface-id***

Syntax Description

interface	Specifies the stacking partner interface.
partner-interface-id	The slot and port number of the stacking partner interface, such as 0/1.

Defaults

There is no default setting.

Command Modes

Interface configuration

Command History

Release	Modification
12.3(8)T4	This command was introduced.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into 15.0(1)MR.

Examples

The following example shows the output generated by this command:

```
Router(config)# interface gigabitethernet0/3
Router(config-if)# switchport stacking-partner interface gigabitethernet0/4
```

Related Commands

Command	Description
show interface switchport	Displays status information about the switchport.

switchport vlan mapping

To map the traffic arriving on the VLAN *original-vlan-id* to the VLAN *translated-vlan-id* and the traffic that is internally tagged with the VLAN *translated-vlan-id* with the VLAN *original-vlan-id* before leaving the port, use the **switchport vlan mapping** command in interface configuration mode. To clear the mapping between a pair of VLANs or clear all the mappings that are configured on the switch port, use the **no** form of this command.

switchport vlan mapping *original-vlan-id translated-vlan-id*

no switchport vlan mapping {*original-vlan-id translated-vlan-id* | **all**}

Syntax Description

original-vlan-id	Original VLAN number; valid values are from 1 to 4094.
translated-vlan-id	Translated VLAN number; valid values are from 1 to 4094.
all	Clears all the mappings that are configured on the switch port.

Defaults

No mappings are configured on any switch port.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(17b)SXA	Support for this command was introduced on the Supervisor Engine 720.
12.2(18)SXE	This command is not supported on GE Layer 2 WAN ports.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is not supported on GE Layer 2 WAN ports.

VLAN translation is not supported on HWIC interfaces.

You must enable VLAN translation on the port where you want VLAN translation to work. Use the **switchport vlan mapping enable** command to enable VLAN translation.

Do not remove the VLAN that you are translating from the trunk. When you map VLANs, make sure that both VLANs are allowed on the trunk that carries the traffic.

The mapping that you configured using the **switchport vlan mapping** command does not become effective until the switch port becomes an operational trunk port.

You can map any two VLANs regardless of the trunk types carrying the VLANs.

Examples

This example shows how to map the original VLAN to the translated VLAN:

```
Router(config-if)# switchport vlan mapping 100 201
```

This example shows how to clear the mappings that are between a pair of VLANs:

```
Router(config-if)# no switchport vlan mapping 100 201
```

This example shows how to clear all the mappings that are configured on the switch port:

```
Router(config-if)# no switchport vlan mapping all
```

Related Commands

Command	Description
show interfaces vlan mapping	Display the status of a VLAN mapping on a port.
show vlan mapping	Registers a mapping of an 802.1Q VLAN to an ISL VLAN.
switchport vlan mapping enable	Enables VLAN mapping per switch port.

switchport vlan mapping enable

To enable VLAN mapping per switch port, use the **switchport vlan mapping enable** command in interface configuration mode. To disable VLAN mapping per switch port, use the **no** form of this command.

switchport vlan mapping enable

no switchport vlan mapping enable

Syntax Description

This command has no arguments or keywords.

Defaults

VLAN mapping is disabled on all switch ports.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(17b)SXA	Support for this command was introduced on the Supervisor Engine 720.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command is not supported on Cisco 7600 series routers that are configured with a Supervisor Engine 2.

Note You must enter the **switchport vlan mapping enable** command on the port where you want the mapping to take place.

The **switchport vlan mapping enable** command enables or disables VLAN-mapping lookup in the hardware regardless of whether the mapping is configured by the global VLAN mapping command or the switchport VLAN mapping command.

This command is useful on the hardware that supports VLAN mapping per ASIC only because you can turn on or off VLAN translation selectively on ports that are connected to the same port ASIC.

Examples

This example shows how to enable VLAN mapping per switch port:

```
Router(config-if)# switchport vlan mapping enable
```

This example shows how to disable VLAN mapping per switch port:

```
Router(config-if)# no switchport vlan mapping enable
```

Related Commands

Command	Description
show interfaces vlan mapping	Displays the status of a VLAN mapping on a port.
show vlan mapping	Registers a mapping of an 802.1Q VLAN to an ISL VLAN.
switchport vlan mapping	Maps the traffic arriving on the VLAN *original-vlan-id* to the VLAN *translated-vlan-id* and the traffic that is internally tagged with the VLAN *translated-vlan-id* with the VLAN *original-vlan-id* before leaving the port.

synchronous mode

To set an Ethernet interface in synchronous mode, use the **synchronous mode** command in interface configuration mode. To disable synchronous mode, use the **no** form of this command.

synchronous mode

no synchronous mode

Syntax Description

No arguments or keywords.

Defaults

Synchronous mode is disabled by default.

Command Modes

Interface configuration (config-if)

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

This command enables ESMC and quality-level clock selection. To disable ESMC, use the **no esmc mode** command. To disable quality-level clock selection, use the **esmc mode ql-disabled** command.

Examples

The following example shows how to use the **network-clock-select** command:

```
Router# config t
Router(config)# interface gigabitethernet 0/2
Router(config-if)# synchronous mode
Router(config-if)# exit
Router#
```

Related Commands

Command	Description
esmc mode	Enables ESMC on an interface.
esmc mode ql-disabled	Disables quality level clock selection on a synchronous Ethernet interface.

tdm-group

To configure a list of time slots for creating clear channel groups (pass-through) for time-division multiplexing (TDM) cross-connect, use the **tdm-group** command in controller configuration mode. To delete a clear channel group, use the **no** form of this command.

tdm-group *tdm-group-no* **timeslot** *timeslot-list*

no tdm-group *tdm-group-no* **timeslot** *timeslot-list*

Syntax Description

tdm-group-no	TDM group number.
timeslot	Time-slot number.
timeslot-list	Time-slot list. T1 range is 1 to 24. E1 range is 1 to 15 and 17 to 31.

Command Default

No TDM group is configured.

Command Modes

Controller configuration

Command History

Release	Modification
11.3(1)MA	This command was introduced on Cisco MC38310.
12.1(1)T	This command was modified to include voice WAN interface cards (VWICs) for Cisco 2600 series and Cisco 3600 series.
12.1(2)T	This command was modified for the OC-3/STM-1 ATM Circuit Emulation Service network module on Cisco 2600 series and Cisco 3600 series.
15.1(1)MR	This command was integrated into Cisco IOS Release 15.1(1)MR.

Usage Guidelines

The **tdm-group** command allows specific timeslots to switch from port 0 to port 1 and vice versa. This command is similar to the **channel-group** command, but it does not create a serial interface to terminate the specified channels.

Examples

The following example configures TDM group 1 to include timeslots 13 through 20:

```
controller T1 1
 tdm-group 1 timeslots 13-20
```

The following examples configures a channelized connection by defining two TDM groups with separate channel assignments.

```
controller E1 0/0
 tdm-group 0 timeslots 1-10
 tdm-group 1 timeslots 11-20
```

Related Commands

Command	Description
connect	Starts passage of data between ports for cross-connect TDM.

termination

Configures the DSL interface to function as central office equipment or customer premises equipment. Use the **no** form of this command to remove the configuration.

termination {co | cpe}

no termination {co | cpe}

Syntax Description

co	The WIC functions as central office equipment and can interface with another G.SHDSL WIC configured as cpe
cpe	The WIC functions as customer premises equipment and can interface with a DSLAM or with another G.SHDSL WIC configured as co.

Command Default

The default setting is **cpe**.

Command Modes

Controller configuration

Command History

Release	Modification
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Examples

The following example shows how to use the **termination** command:

```
Router# configure terminal
Router(config)# controller shdsl2/0
Router(config-controller)# equipment-type co
```

Related Commands

Command	Description
controller	Configures the digital subscriber line (DSL) controller.

traceroute ethernet

To send Ethernet connectivity fault management (CFM) traceroute messages to a destination maintenance endpoint (MEP), use the **traceroute ethernet** command in privileged EXEC mode. This command does not have a **no** form.

traceroute ethernet {*mac-address* | **mpid** *mpid*} {**domain** *domain-name* {**evc** *evc-name* | **port** | **vlan** *vlan-id*}} [**cos** *value*] [**fdb-only** | **source** *mpid*]

Syntax Description

mac-address	MAC address of a remote MEP in the format abcd.abcd.abcd.
mpid	Specifies a destination MEP.
mpid	Integer from 1 to 8191 that identifies the MEP.
domain	Specifies the domain in which the destination MEP resides.
domain-name	String of a maximum of 154 characters that identifies the domain.
evc	Specifies an Ethernet virtual circuit (EVC).
evc-name	String that identifies the EVC.
port	Specifies a DOWN service with no VLAN association (untagged).
vlan	Specifies a VLAN.
vlan-id	Integer from 1 to 4094 that identifies the VLAN.
cos	(Optional) Specifies a class of service (CoS).
value	(Optional) Integer from 0 to 7 that identifies the CoS.
fdb-only	(Optional) Specifies the forwarding database (FDB) table.
source	(Optional) Specifies a source MEP.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.2(33)SXI2	This command was introduced.
12.2(33)SRE	This command was modified. Support for the **evc** keyword was added in Cisco IOS Release 12.2(33)SRE.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

If a CoS is not configured, the default is the highest priority allowed for the egress interface.

FDB is another term for the L2 forwarding table. When the **fdb-only** option is configured, only MAC addresses learned in a bridge's FDB (not information saved in the maintenance intermediate point [MIP] continuity check database [CCDB]) are used to determine the egress port.

The destination can be either a MEP or a MIP. If the destination is a MIP, the FDB must have a MAC address entry for that MIP; that is, the FDB has learned the MIP's MAC address via Linktrace responses.

For a bridge domain-VLAN service, the VLAN ID can be used to initiate traceroute.

On the Cisco Catalyst 6500 series switch, an FDB configuration will work only if the origination MEP is a down MEP. Also, for a MEP to clear the Alarm Indication Signal (AIS) defect condition, there should be no corresponding entry in the error database. For example, if you change the remote MEP from an UP MEP to a DOWN MEP, the local entry will time out and enter the AIS defect condition. The database starts receiving a new CC entry based on the newly configured DOWN MEP, but the local AIS defect is not yet cleared. It will remain in the AIS state until either the archive hold time expires or you issue the **clear ethernet cfm errors** command.

The following example shows a **traceroute ethernet** command and output:

```
Router# traceroute ethernet mpid 401 domain Domain_L5 vlan 9

Type escape sequence to abort. TTL 64. Linktrace Timeout is 5 seconds
Tracing the route to aabb.cc03.bb99 on Domain Domain_L5, Level 5, vlan 9
Traceroute sent via Ethernet0/0.9, path found via MPDB

B = Intermediary Bridge
! = Target Destination
* = Per hop Timeout
-------------------------------------------------------------------------------
                            MAC      Ingress      Ingr Action  Relay Action
  Hops   Host             Forwarded   Egress       Egr Action   Previous Hop
-------------------------------------------------------------------------------
! 1                   aabb.cc03.bb99                           RlyHit:MEP
                     Not Forwarded                            aabb.cc03.b999
```

Related Commands

Command	Description
clear ethernet cfm errors	Removes continuity check error conditions from the error database.
clear ethernet cfm traceroute-cache	Removes the contents of the traceroute cache.
ethernet cfm traceroute-cache	Enables caching of Ethernet CFM data learned through traceroute messages.
show ethernet traceroute-cache	Displays the contents of the traceroute cache.

tunnel destination

To specify the destination for a tunnel interface, use the **tunnel destination** command in interface configuration mode. To remove the destination, use the **no** form of this command.

tunnel destination {*host-name* | *ip-address*}

no tunnel destination

Syntax Description

host-name	Name of the host destination.
ip-address	IP address of the host destination expressed in dotted decimal notation.

Command Default

No tunnel interface destination is specified.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.3(7)T	The address field was modified to accept an *ipv6-address* argument to allow IPv6 nodes to be configured as a tunnel destination.
12.2(30)S	This command was integrated into Cisco IOS Release 12.2(30)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(25)SG	This command was integrated into Cisco IOS Release 12.2(25)SG.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

You cannot configure two tunnels to use the same encapsulation mode with exactly the same source and destination address. The workaround is to create a loopback interface and configure the packet source off of the loopback interface.

Examples

Tunnel Destination Address for GRE Tunneling Example

The following generic routing encapsulation (GRE) example shows how to configure the tunnel destination address for GRE tunneling:

```
Router(config)# interface tunnel0
Router(config-if)# tunnel source ethernet0
```

```
Router(config-if)# tunnel destination 10.108.164.19
Router(config-if)# tunnel mode gre ip
```

Related Commands

Command	Description
tunnel mode	Sets the encapsulation mode for the tunnel interface.
tunnel source	Sets the source address of a tunnel interface.

tunnel source

To set the source address for a tunnel interface, use the **tunnel source** command in interface configuration mode. To remove the source address, use the **no** form of this command.

tunnel source {*ip-address* | *interface-type interface-number*}

no tunnel source

Syntax Description

ip-address	IP address to use as the source address for packets in the tunnel.
interface-type	Interface type.
interface-number	Port, connector, or interface card number. The numbers are assigned at the factory at the time of installation or when added to a system and can be displayed with the **show interfaces** command.

Command Default

No tunnel interface source address is set.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.3(7)T	The address field has been updated to accept IPv6 addresses as the source address to allow an IPv6 node to be used as a tunnel source.
12.2(30)S	This command was integrated into Cisco IOS Release 12.2(30)S.
12.2(25)SG	This command was integrated into Cisco IOS Release 12.2(25)SG.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

The source address is either an explicitly defined IP address or the IP address assigned to the specified interface.

You cannot have two tunnels using the same encapsulation mode with exactly the same source and destination address. The workaround is to create a loopback interface and source packets off of the loopback interface.

Examples

GRE Tunneling Example

The following example shows how to set a tunnel source address for generic routing encapsulation (GRE) tunneling:

```
Router(config)# interface tunnel0
Router(config-if)# tunnel source ethernet0
Router(config-if)# tunnel destination 172.32.164.19
Router(config-if)# tunnel mode gre ip
```

Related Commands

Command	Description
tunnel destination	Specifies the destination for a tunnel interface.

tx-limit

To specify the number of transmit buffers for an ATM virtual circuit (VC), use the **tx-limit** command in ATM VC, VC-bundle, VC-class, or VC-range configuration mode. To reset the number of transmit buffers for a particular VC to the default value, use the **no** form of this command.

tx-limit *buffers*

no tx-limit

Syntax Description

buffers	Specifies the number of buffers to be used for this VC. The valid range is 2 to 57343, with a default value that is based on the current VC line rate. **Note** Avoid configuring the *buffer* value as 1, as this can cause a traffic error on the Cisco MWR 2941.

Defaults

Automatically computed from the VC line rate to produce a default latency of 100 milliseconds (or whatever value is specified by the **atm tx-latency** command).

Command Modes

Interface-ATM-VC configuration (for an ATM VC)

VC-bundle configuration

VC-class configuration

VC-range configuration

Command History

Release	Modification
12.2(18)SXE	This command was introduced for the ATM Shared Port Adapters (SPA) on Catalyst 6500 series switches and Cisco 7600 series routers.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)MRB	This command was integrated into Cisco IOS Release 12.2.(33)MRB.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

When you configure a VC on an ATM SPA interface, the Cisco IOS software automatically determines the maximum number of transmit buffers that are needed by the VC for its outgoing traffic. The Cisco IOS software uses both the configured VC line rate and latency value to calculate the number of buffers. Each transmit buffer can contain an ATM cell (53 bytes).

By default, each VC uses the latency value that is specified by the **atm tx-latency** command, which defaults to 100 milliseconds. The maximum number of transmit buffers is then calculated, so that traffic at the maximum VC line rate can still be transmitted within this latency value.

If a particular VC's traffic flow requires a different latency value, use the **tx-limit** command to manually configure the number of transmit buffers for that VC. This allows you to fine-tune the latency value on a per-VC basis, without affecting the other VCs on the interface.

Tip Use the **atm tx-latency** command to specify the default latency value for all VCs on the interface, and then use the **tx-limit** command to fine-tune the configuration for a particular VC, as needed.

Note The number of buffers can also be affected by the packet size, because each VC is always allowed to transmit at least one packet, regardless of the number of buffers configured with the **tx-limit** command. If the number of buffers specified by the **tx-limit** command is very small, and the VC must transmit a very large packet, the interface can increase the number of buffers for the VC to whatever number can accommodate the packet's size. This means that occasionally, the number of buffers can grow to whatever number can accommodate a packet up to the maximum MTU size.

Note Other ATM interfaces have used the **tx-ring-limit** command to achieve a similar result, but this command is not supported on ATM SPA interfaces, because it does not apply to the SPA architecture.

Examples

The following example shows an ATM VC being configured for a maximum of 500 buffers:

```
Router# configure terminal
Router(config)# interface atm 4/0/0.10 point-to-point
Router(config-subif)# pvc 10/101
Router(config-if-atm-vc)# tx-limit 500
Router(config-if-atm-vc)#
```

The following example shows an ATM VC being reset for its default buffer value, which will be whatever buffer size is needed, at the VC line rate, to produce a default latency of 100 milliseconds (or whatever value is specified by the **atm tx-latency** command):

```
Router# configure terminal
Router(config)# interface atm 3/0/1.10 point-to-point
Router(config-subif)# pvc 10/20
Router(config-if-atm-vc)# no tx-limit
Router(config-if-atm-vc)#
```

Related Commands

Command	Description
atm tx-latency	Specifies the default transmit latency for an ATM Shared Port Adapter (SPA) interface.

ubr+

To configure unspecified bit rate (UBR) quality of service (QoS) and specify the output peak cell rate and output minimum guaranteed cell rate for an ATM permanent virtual circuit (PVC), PVC range, switched virtual circuit (SVC), virtual circuit (VC) class, or VC bundle member, use the **ubr+** command in the appropriate command mode. To remove the UBR+ parameters, use the **no** form of this command.

ubr+ *output-pcr output-mcr* [*input-pcr*] [*input-mcr*]

no ubr+ *output-pcr output-mcr* [*input-pcr*] [*input-mcr*]

Syntax Description

output-pcr	The output peak cell rate (PCR) in kbps.
output-mcr	The output minimum guaranteed cell rate in kbps.
input-pcr	(Optional for SVCs only) The input PCR in kbps. If this value is omitted, the *input-pcr* equals the *output-pcr*.
input-mcr	(Optional for SVCs only) The input minimum guaranteed cell rate in kbps. If this value is omitted, the *input-mcr* equals the *output-mcr*.

Defaults

UBR QoS is at the maximum line rate of the physical interface.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC on non-DSL interfaces only or an ATM SVC on non-DSL interfaces only)
VC-class configuration (for a VC class)
Bundle-VC configuration (for ATM VC bundle members)
PVC range configuration (for an ATM PVC range)
PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	This command was enhanced to support selection of UBR+ QoS and configuration of output PCR and output minimum guaranteed cell rate for ATM VC bundles and VC bundle members.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.
12.4(2)XA	This command was enabled on DSL ATM interfaces.
12.4(6)T	This command was enabled on DSL ATM interfaces.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

To configure ATM SVCs with an output PCR and an input PCR that differ from each other, you must expressly configure an output value and an input value using the *output-pcr, output-mcr, input-pcr,* and *input-mcr* arguments.

Configure QoS parameters using the **ubr**, **ubr+**, or **vbr-nrt** command. The last command that you enter will apply to the PVC or SVC that you are configuring.

If the **ubr+** command is not explicitly configured on an ATM PVC or SVC, the VC inherits the following default configuration (in order of precedence):

- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC or SVC itself
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC ATM subinterface or SVC ATM subinterface
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC main interface or SVC ATM main interface
- Global default: UBR QoS at the maximum line rate of the PVC or SVC

To use this command in VC-class configuration mode, enter the **vc-class atm** global configuration command before you enter the **ubr+** command. This command has no effect if the VC class that contains the command is attached to a standalone VC (meaning a VC that is not a bundle member).

To use this command in bundle-VC configuration mode, enter the **bundle** command to specify the bundle to which the VC member belongs, then enter bundle configuration mode. Finally, enter the **pvc-bundle** bundle configuration command to add the VC to the bundle as a member.

VCs in a VC bundle use the following configuration inheritance rules (in order of next-highest precedence):

- VC configuration in bundle-VC mode
- Bundle configuration in bundle mode (with effect of assigned VC-class configuration)
- Subinterface configuration in subinterface mode

DSL ATM interfaces do not support switched virtual circuits (SVCs).

Examples

The following example configures UBR+ PVC on a DSL line:

```
interface atm 0/0
 pvc 4/100
  ubr+ 2304 2304
```

The following example specifies the *output-pcr* argument for an ATM PVC to be 100000 kbps and the *output-mcr* to be 3000 kbps:

```
pvc 1/32
 ubr+ 100000 3000
```

The following example specifies the *output-pcr*, *output-mcr*, *input-pcr*, and *input-mcr* arguments for an ATM SVC to be 10000 kbps, 3000 kbps, 9000 kbps, and 1000 kbps, respectively:

```
svc lion nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05
 ubr+ 10000 3000 9000 1000
```

Related Commands

Command	Description
encapsulation	Sets the encapsulation method used by the interface.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle.
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, VC class, or VC bundle member.
vbr-rt	Configures variable bit rate real-time for VoATM voice connections.

udp port

To specify a local and remote UDP port for a pseudowire connection, use the **udp port** command in CEM interface configuration mode. To remove the configuration, use the **no** form of this command.

udp port local *local-port* **remote** *remote-port*

no **udp port local** *local-port* **remote** *remote-port*

Syntax Description

local-port	Specifies the local UDP port number. Valid port values for CESoPSN pseudowires using UDP are from 49152–57343.
remote-port	Specifies the remote UDP port number. Valid port values for CESoPSN pseudowires using UDP are from 49152–57343.

Command Default

This command is disabled by default.

Command Modes

CEM interface configuration

Command History

Release	Modification
15.0(1)MR	This command was introduced.

Usage Guidelines

When using this command, you must configure UDP encapsulation on the pseudowire class used for the CESoPSN connection.

Examples

The following partial configuration enables UDP encapsulation on a CESoPSN pseudowire.

```
interface Loopback0
ip address 2.2.2.8 255.255.255.255
!
pseudowire-class udpClass
encapsulation udp
protocol none
ip local interface Loopback 0
!
controller E1 0/13
clock source internal
cem-group 0 timeslots 1-31
!
interface cem 0/13
cem 0
xconnect 2.2.2.9 200 pw-class udpClass
udp port local 50000 remote 60000
```

Related Commands

Command	Description
encapsulation udp	Configures a pseudowire-class to use UDP encapsulation instead TCP.

vbr-nrt

To configure the variable bit rate-nonreal time (VBR-NRT) quality of service (QoS) and specify output peak cell rate (PCR), output sustainable cell rate (SCR), and output maximum burst cell size for an ATM permanent virtual circuit (PVC), PVC range, switched virtual circuit (SVC), VC class, or VC bundle member, use the **vbr-nrt** command in the appropriate command mode. To remove the VBR-NRT parameters, use the **no** form of this command.

vbr-nrt *output-pcr output-scr output-maxburstsize* [*input-pcr*] [*input-scr*] [*input-maxburstsize*]

no vbr-nrt *output-pcr output-scr output-maxburstsize* [*input-pcr*] [*input-scr*] [*input-maxburstsize*]

Syntax Description

output-pcr	The output PCR, in kilobits per second (kbps).
output-scr	The output SCR, in kbps.
output-maxburstsize	The output maximum burst cell size, expressed in number of cells.
input-pcr	(Optional for SVCs only) The input PCR, in kbps.
input-scr	(Optional for SVCs only) The input SCR, in kbps.
input-maxburstsize	(Optional for SVCs only) The input maximum burst cell size, expressed in number of cells.

Command Default

Unspecified bit rate (UBR) QoS at the maximum line rate of the physical interface is the default.

Command Modes

ATM PVC-in-range configuration (for an individual PVC within a PVC range)
ATM PVC range configuration (for an ATM PVC range)
ATM PVP configuration
Bundle-vc configuration (for ATM VC bundle members)
Interface-ATM-VC configuration (for an ATM PVC or SVC)
VC-class configuration (for a VC class)

Command History

Release	Modification
11.3T	This command was introduced.
12.0(3)T	This command was enhanced to support configuration of VBR-NRT QoS and specification of output PCR, output SCR, and output maximum burst cell size for ATM bundles and VC bundle members.
12.0(25)SX	This command was integrated into Cisco IOS Release 12.0(25)SX and implemented on the Cisco 10000 series router.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Release	Modification
Cisco IOS XE Release 2.3	This command was made available in ATM PVP configuration mode.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Configure QoS parameters using the **ubr**, **ubr+**, or **vbr-nrt** command. The last command you enter will apply to the PVC or SVC you are configuring.

If the **vbr-nrt** command is not explicitly configured on an ATM PVC or SVC, the VC inherits the following default configuration (listed in order of precedence):

- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC or SVC itself.
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM subinterface.
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM main interface.
- Global default: UBR QoS at the maximum line rate of the PVC or SVC.

To use this command in VC-class configuration mode, enter the **vc-class atm** global configuration command before you enter the **vbr-nrt** command. This command has no effect if the VC class that contains the command is attached to a standalone VC, that is, if the VC is not a bundle member.

To use this command in bundle-vc configuration mode, enter the **pvc-bundle** configuration command and add the VC as a bundle member.

VCs in a VC bundle are subject to the following configuration inheritance rules (listed in order of precedence):

- VC configuration in bundle-vc mode
- Bundle configuration in bundle mode (with the effect of assigned VC-class configuration)
- Subinterface configuration in subinterface mode

Examples

The following example specifies the output PCR for an ATM PVC to be 100,000 kbps, the output SCR to be 50,000 kbps, and the output MBS to be 64:

```
pvc 1/32
 vbr-nrt 100000 50000 64
```

The following example specifies the VBR-NRT output and input parameters for an ATM SVC:

```
svc atm-svc1 nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05
 vbr-nrt 10000 5000 32 20000 10000 64
```

Related Commands

Command	Description
encapsulation	Sets the encapsulation method used by the interface.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle, and enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class, or VC bundle member.

vbr-rt

To configure the real-time variable bit rate (VBR) for VoATM voice connections, use the **vbr-rt** command in the appropriate configuration mode. To disable VBR for voice connections, use the **no** form of this command.

vbr-rt *peak-rate average-rate burst*

no vbr-rt

Syntax Description

peak-rate	Peak information rate (PIR) for the voice connection, in kilobits per second (kbps). If it does not exceed your carrier's line rate, set it to the line rate. Range is from 56 to 10000.
average-rate	Average information rate (AIR) for the voice connection, in kbps.
burst	Burst size, in number of cells. Range is from 0 to 65536.

Command Default

No real-time VBR settings are configured.

Command Modes

ATM Bundle-vc configuration for ATM VC bundle members
ATM PVP configuration for an ATM PVP
Interface-ATM-VC configuration for an ATM permanent virtual connection (PVC) or switched virtual circuit (SVC)
VC-class configuration for a virtual circuit (VC) class

Command History

Release	Modification
12.0	This command was introduced on the Cisco MC3810.
12.1(5)XM	This command was implemented on Cisco 3600 series routers and modified to support Simple Gateway Control Protocol (SGCP) and Media Gateway Control Protocol (MGCP).
12.2(2)T	This command was integrated into Cisco IOS Release 12.2(2)T.
12.2(11)T	This command was implemented on the Cisco AS5300 and Cisco AS5850.
Cisco IOS XE Release 2.3	This command was made available in ATM PVP configuration mode.
12.4(20)MR	This command was integrated into Cisco IOS Release 12.4(20)MR.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

This command configures traffic shaping between voice and data PVCs. Traffic shaping is required so that the carrier does not discard calls. To configure voice and data traffic shaping, you must configure the peak, average, and burst options for voice traffic. Configure the burst value if the PVC will carry bursty traffic. Peak, average, and burst values are needed so that the PVC can effectively handle the bandwidth for the number of voice calls.

Calculate the minimum peak, average, and burst values for the number of voice calls as follows:

Peak Value

Peak value = (2 x the maximum number of calls) x 16K = _____

Average Value

Calculate according to the maximum number of calls that the PVC will carry times the bandwidth per call. The following formulas give you the average rate in kbps:

- For VoIP:
  - G.711 with 40- or 80-byte sample size:

    Average value = max calls x 128K = _____
  - G.726 with 40-byte sample size:

    Average value = max calls x 85K = _____
  - G.729a with 10-byte sample size:

    Average value = max calls x 85K = _____
- For VoATM adaptation layer 2 (VoAAL2):
  - G.711 with 40-byte sample size:

    Average value = max calls x 85K = _____
  - G.726 with 40-byte sample size:

    Average value = max calls x 43K = _____
  - G.729a with 10-byte sample size:

    Average value = max calls x 43K = _____

If voice activity detection (VAD) is enabled, bandwidth usage is reduced by as much as 12 percent with the maximum number of calls in progress. With fewer calls in progress, bandwidth savings are less.

Burst Value

Set the burst size as large as possible, and never less than the minimum burst size. Guidelines are as follows:

- Minimum burst size = 4 x number of voice calls = _____
- Maximum burst size = maximum allowed by the carrier = _____

When you configure data PVCs that will be traffic shaped with voice PVCs, use AAL5snap encapsulation and calculate the overhead as 1.13 times the voice rate.

Examples

The following example configures the traffic-shaping rate for ATM PVC 20. Peak, average, and burst rates are calculated based on a maximum of 20 calls on the PVC.

```
Router# configure terminal
Router(config)# interface atm0/0
Router(config-if)# pvc 20
Router(config-if-atm-vc)# encapsulation aal5mux voice
Router(config-if-atm-vc)# vbr-rt 640 320 80
```

Related Commands

Command	Description
encapsulation aal5	Configures the AAL and encapsulation type for an ATM PVC, SVC, or VC class.

xconnect

To bind an attachment circuit to a pseudowire, use the **xconnect** command in one of the supported configuration modes. To restore the default values, use the **no** form of this command.

xconnect *peer-ip-address* | *vcid* | *pseudowire-parameters*

no xconnect

Syntax Description

peer-ip-address	IP address of the remote provider edge (PE) peer. The remote router ID can be any IP address, as long as it is reachable.
vcid	The 32-bit identifier of the virtual circuit (VC) between the PE routers.
pseudowire-parameters	Encapsulation and pseudowire-class parameters to be used for the attachment circuit. At least one of the following PW parameters must be configured: • **encapsulation** {**l2tpv3** | **mpls**}— Specifies the tunneling method to encapsulate the data in the PW: – **l2tpv3**—Specifies L2TPv3 as the tunneling method. – **mpls**—Specifies MPLS as the tunneling method. **Note** L2TP is not currently supported on the Cisco MWR 2941. • **pw-class** *pw-class-name*—Specifies the pseudowire-class configuration from which the data encapsulation type is taken. This option is mandatory if you select an encapsulation method.
transmit	Sequences data packets received from the attachment circuit.
receive	Sequences data packets sent into the attachment circuit.
both	Sequences data packets that are both sent and received from the attachment circuit.

Defaults

The attachment circuit is not bound to the PW.

Command Modes

CEM circuit configuration

Interface configuration

Subinterface configuration

l2transport configuration (for ATM)

Connect configuration

Global configuration

Command History

Release	Modification
12.0(23)S	This command was introduced.
12.0(28)S	Support was added for Multilink Frame Relay connections.

Release	Modification
12.3(2)T	This command was integrated into Cisco IOS Release 12.3(2)T.
12.2(25)S	This command was integrated into Cisco IOS Release 12.2(25)S.
12.2(27)SBC	This command was integrated into Cisco IOS Release 12.2(27)SBC.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SRB	This command was updated to add support for AToM static pseudowires, and so that the remote router ID need not be the Label Distribution Protocol (LDP) router ID of the peer.
12.4(19)MR2	This command was integrated into Cisco IOS Release 12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR. This release does not support the **ignore-vpi-vci** or the **one-to-one** keywords.

Usage Guidelines

The combination of the *peer-ip-address* and *vcid* arguments must be unique on the router. Each xconnect configuration must have a unique combination of peer IP address and VCID configuration.

The same *vcid* value that identifies the attachment circuit must be configured using the **xconnect** command on the local and remote PE routers. The *vcid* argument creates the binding between a PW and an attachment circuit.

The **pw-class** *pw-class-name* value binds the xconnect configuration of an attachment circuit to a specific pseudowire-class. In this way, the pseudowire-class configuration serves as a template that contains settings used by all attachment circuits bound to it with the **xconnect** command.

Note If you specify the encapsulation keywords, you must specify the **pw-class** keyword.

Examples

The following example configures **xconnect** service for an ATM interface by binding the ATM circuit to the PW named 123 with a remote peer 10.0.3.201. The configuration settings in the pseudowire class named ATM-xconnect are used.

```
Router# config tby
Router(config)# interface ATM 0/0
Router(config-if)# xconnect 10.0.3.201 123 pw-class ATM-xconnect
Router(config-if-xconn)# exit
Router(config-if)# exit
Router(config)# exit
```

Related Commands

Command	Description
pseudowire-class	Configures a template of PW configuration settings used by the attachment circuits transported over a PW.
show xconnect	Displays information about xconnect attachment circuits and PWs.

xconnect logging redundancy

To enable system message log (syslog) reporting of the status of the xconnect redundancy group, use the **xconnect logging redundancy** command in global configuration mode. To disable syslog reporting of the status of the xconnect redundancy group, use the **no** form of this command.

xconnect logging redundancy

no xconnect logging redundancy

Syntax Description

This command has no arguments or keywords.

Defaults

Syslog reporting of the status of the xconnect redundancy group is disabled.

Command Modes

Global configuration

Command History

Release	Modification
12.0(31)S	This command was introduced.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.
12.2(33)SRB	This command was integrated into Cisco IOS Release 12.2(33)SRB.
12.2(33)SXI	This command was integrated into Cisco IOS Release 12.2(33)SXI.
12.4(19)MR2	This command was integrated into Cisco IOS Release12.4(19)MR2.
12.2(33)MRA	This command was integrated into Cisco IOS Release 12.2(33)MRA.
15.0(1)MR	This command was integrated into Cisco IOS Release 15.0(1)MR.

Usage Guidelines

Use this command to enable syslog reporting of the status of the xconnect redundancy group.

Examples

The following example enables syslog reporting of the status of the xconnect redundancy group and shows the messages that are generated during switchover events:

```
Router# config t
Router(config)# xconnect logging redundancy
Router(config)# exit
```

Activating the Primary Member

```
00:01:07: %XCONNECT-5-REDUNDANCY: Activating primary member 10.55.55.2:1000
```

Activating the Backup Member:

```
00:01:05: %XCONNECT-5-REDUNDANCY: Activating secondary member 10.55.55.3:1001
```

Related Commands

Command	Description
xconnect	Binds an Ethernet, 802.1q VLAN, or Frame Relay attachment circuit to an Layer 2 PW for xconnect service and enters xconnect configuration mode.